KW-2

BANGALORE WATER SUPPLY AND SEWERAGE BOARD

CAUVERY BHAVAN, KEMPEGOWDA ROAD,
BANGALORE – 560 009

SHORT TERM TENDER

Name of the Work: Tender for the work of providing and laying of various dia DI/MS line inplace of old CI line at Hosahalli uru, Hosahalli colony Vijayanagar RPC layout & surrounding area coming under Hosahalli Service station of AEEW-1-1 sub division

(Through kppp only)

http://www.kppp.karnataka.gov.in

Office of the Executive Engineer,
BANGALORE WATER SUPPLY & SEWERAGE BOARD
WEST-1 DIVISION,
RPC Layout, Vijaynagar 2nd Stage, Bangalore-560040

e-mail – eew@bwssb.gov.in

KW-2 Others Category

TENDER REFERENCE :	**:**	**BWSSB/EEW-1/PB/5642/2025-26 Dated:20.02.2026**	
PERIOD OF SUBMISSION OF TENDER DOCUMENT	**:**	**From:21.02.2026**	**To:03.03.2026**
LAST DATE FOR SUBMISSION OF TENDER DOCUMENT	**:**	**03.03.2026upto 16:00 Hrs**	
LAST DATE AND TIME FOR RECEIPT OF TENDERS	**:**	**03.03.2026 upto 16:00 Hrs**	
TIME AND DATE OF OPENING OF TENDERS	**:**	**04.03.2026 After 16:30 Hrs**	
PLACE OF OPENING OF TENDER	**:**	Office of the Executive Engineer, Water Supply & Sanitary Division(West)-1, 9th main, 5th cross, Vijaynagar, 2nd stage, RPC Layout Bangalore-560040	
ADDRESS FOR COMMUNICATION	**:**	Office of the Executive Engineer, Water Supply & Sanitary Division(West)-1, 9th main, 5th cross, Vijaynagar, 2nd stage, RPC Layout Bangalore-560040. e-mail – eew@bwssb.gov.in	

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SECTION 1:

BANGALORE WATER SUPPLY AND SEWERAGE BOARD

Office of the Executive Engineer,
WEST-1 DIVISION,
RPC Layout, Vijaynagar 2nd stage, Bangalore-560040
Email:eew@bwssb.gov.in

INVITATION FOR TENDER

(ONLY THROUGH KPPP PORTAL)

IFT No: BWSSB/EEW-1/TO/PB/5642/2025-26 DATE:20.02.2026

For and on behalf of the Bangalore Water Supply and Sewerage Board, **ITEMWAR TENDER is** invited through KPPP process with tender procedure in line with Rule 28 of the KTPP Act by the Executive Engineer, Water Supply and Sanitary Division (West)-1, RPC Layout, Vijaynagar 2nd stage, Bangalore-560040 for the following work from registered Agencies of appropriate class as indicated against each work of **BWSSB/KUWSDB/KPWD,** etc. Who are having adequate financial resources, past experience in similar nature of work possessing valid GST registration. The Board keeps the right of acceptance or rejection of any tender without assigning any reasons.

The Tenderers are required to pay the Earnest Money Deposit only through KPPP portal only using any of the four modes.

1. (1)Credit Card (Online Payment) (2) Direct Debit Using Internet Banking (Online Payment) (3) Remittance at the Bank Counter - Challan (Offline Payment) (4) NEFT (National Electronic fund transfer) (Offline payment). The details regarding their capability to undertake the tender (as detailed in ITT Clause 4) and the price tender shall be uploaded in the website. Technical details will be opened on the date and time mentioned in ITT clause 5 and evaluated. The price tender of the Tenderer, who is found to be qualified to execute the tendered works, will be opened on the date notified later. The Tenderers are advised to note the minimum qualification criteria specified in Clause 3 of the Instructions to Tenderers to qualify for award of the contract.
2. Tender documents may be downloaded from **http://www.kppp.karnataka.gov.in** website only. Interested tenderers may obtain further information at the same address.
3. Additional information related to KPPP process can be obtained through the above mentioned website or contact KPPP helpdesk No.91-**8046010000 / 8068948777**. The electronic tender comprising Technical and Financial bids will be operated as **One Cover Tender system.**

4. Bidders can access tender documents through www.kppp.karnataka.gov.in website only and upload the required details; those are mentioned in different sections in the bid document in to electronic tender on the website. Scanned documents those are required to be furnished as per Section 2, 3 & 4 of the bid document shall be submitted through kppp portal.
5. The Tender processing fee once paid will not be refunded.
6. The Last date and time for Receipt of tenders will be on **03.03.2026 upto 16.00 Hrs** and date of opening of tender will be **on 04.03.2026 after 16.30 Hrs.**

TABLE

Randomization Lot No. BWSSB/2025-26/ LOT162 dtd: 08.12.2025

Sl. No	Name of work	Amount put to tender	Earnest Money Deposit @ 2.0%	Tender Processes sing fee	Period of Completion of work	Eligibility Class of Contractor
1.	work of providing and laying of various dia DI/MS line inplace of old CI line at Hosahalli uru, Hosahalli colony Vijayanagar RPC layout & surrounding area coming under Hosahalli Service station of AEEW-1-1 sub division	Rs.26,47,610/- GST 18% - Rs.4,76,570/- **Total** Rs.31,24,180/-	Rs.53,000/-	As per KPPP portal	3 Months	Civil Contractor

The Eligibility criterion for the above work is as follows:

- The tender is based on One Cover System.
- Contractors should have civil contractor registration in BWSSB or KPWD/KUWSDB, etc.
- The Tenderer Should have a in the last 5 years period achieved in atleast two financial years an average turnover of not less than estimated cost of the respective works (Profit & loss account, Balance sheet certified/Audited by chartered accountant).i.e., (inclusive of GST) **Rs.31.24 Lakh.**
- The Tenderer should have satisfactorily completed one similar work to an extent of **50% of the cost of the respective works.(inclusive of GST) i.e.,Rs.15.62Lakhs.**
- **Assessed available tender capacity = (A*N*5.0 - B)>31.24 lakhs.**
- Form of tender is mandatory to upload in KPPP portal.
- The rates considered in the tender are based on CSR & is exclusive of GST.
- The Thirty Party inspection will be carried for the work & the Third party will be nominated by BWSSB.

7. The successful bidder would be required to give performance **bank guarantee of 5%** of the contract amount plus additional security for unbalanced bid amount from a from a Nationalized / Scheduled Indian

Bank, with jurisdiction at Bangalore as specified, towards guarantee for completion of work within the stipulated period.

8. Applications / requisitions from joint venture Firms are not acceptable.
9. Bangalore Water Supply and Sewerage Board (BWSSB) reserve the right to cancel or annul the entire or part of this process of invitation at any time without assigning any reason.
10. For any additional information regarding the above tender, the firms who are interested to quote, may contact office of the undersigned at the office address given below on all working days during office hours (10:30hours to 17:00 hours).
11. List of documents to support qualification of bidder is to be uploaded to the kppp website http://www.kppp.karnataka.gov.in
12. Bidders shall submit offers that comply with the requirements of the bid document, including the basic technical design as indicated in the drawing and specifications. Alternatives will not be considered. The attention of the bidders is drawn to clause 23 regarding the rejection of the bids, which are not substantially responsive to the requirement of the bid document.
13. Other details can be seen in the tender documents.
14. The works to be executed in accordance with the contract documents and to carry out all the works as per the guidelines in the "Safety Manual for construction and maintenance of UGD Lines and septic tanks in Urban Areas -2013". Any lapses in following the safety guidelines, the contractor/agency/firm will be held solely responsible.
15. Cutting Road Surfaces for Pipe line trenches should be executed using machineries only.

Further details may be had from this office during the office hours on all working days.

Corrigendum/Addendum/Modification/corrections, if any, will be published in the Web site only.

Executive Engineer
Water Supply & Sanitary Division(West)-1
RPC Layout, Vijaynagar 2nd stage,
Bangalore-560040.

SECTION 2: INSTRUCTIONS TO TENDERERS (ITT)

TABLE OF CLAUSES

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23. Notification of award and signing of agreement
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25. Corrupt or Fraudulent practices

A. General

1. Scope of Tender

1.1 The ***Executive Engineer, (West)-1 Division*** (Referred to as Employer in these documents) invites tenders following Single cover KPPP procedure, from eligible tenderers, for the construction of works (as defined in these documents and referred to as "the work") detailed in the Table given in the Invitation for Tenders (IFT).

2. Eligible Tenderers

2.1 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of Karnataka

2.2 **Tenders from Joint ventures are not acceptable.**

3. Qualification of the Tenderer:

3.1 All tenderers shall provide the requested information accurately and in sufficient detail in Section 3: Form of Tender and Qualification information.

3.2 To qualify for award of this contract, each tenderer in its name should have in the last five years i.e. **2020-21 to 2024-25)**

(a) The Tenderer Should have a in the last 5 years period achieved in atleast two financial years an average turnover of not less than estimated cost of the respective works (Profit & loss account, Balance sheet certified/Audited by chartered accountant).i.e., (inclusive of GST) **Rs.31.24 Lakh.**

(b) The Tenderer should have satisfactorily completed one similar work to an extent of **50% of the cost of the respective works. (inclusive of GST) i.e.,Rs.15.62Lakhs**.

Tenderers who meet the above specified minimum qualifying criteria, will only be qualified, if their available tender capacity is more than the total tender value. The available tender capacity will be calculated as under:

Assessed available tender capacity = (A*N*5.0 - B)> 31.24 Lakhs (Inclusive of GST)

Where

A = Maximum value of civil engineering works executed in any one year during the last five years (updated to **2024-25** price level) taking into account the complete as well as works in progress.

N = Number of years prescribed for completion of the works for which Tenders are Invited.

B = Value, at **2024-25** price level, of existing commitments and on-going works to be Completed during the next **1 years** (period of completion of the works for which Tenders are invited)*

Note: *The statements showing the value of existing commitments and ongoing works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Employer in charge, not below the rank of an Executive Engineer or equivalent.

* The Form of Tender and demonstrated AATC should be duly signed by the tenderer and should be enclosed.

* The Balance sheets for the corresponding annual turnover should be enclosed.

3.4 Even though the renderers meet the above criteria, they are subject to be disqualified if they have:

- Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- Record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- participated in the previous Tender for the same work and had quoted unreasonably high tender prices and could not furnish rational justification.

B. Tender documents

4. Content of Tender documents

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4.1 The set of tender documents shall have all the Sections given in Page 2:

4.2 Both the sets should be completed and returned with the tender.

5. Amendment of Tender documents

5.1 Before the deadline for submission of tenders, the Employer may modify the tender documents by issuing addenda.

5.2 Any addendum thus issued shall be part of the tender documents and shall be communicated in writing or by cable to all the purchasers of the tender documents.

5.3 To give prospective tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend as necessary the deadline for submission of tenders, in accordance with Sub-Clause 12.2 below.

C. Preparation of Tenders

6. Documents comprising the Tender

6.1 The tender submitted by KPPP by the Tenderer shall contain the document as following:

(a) The Tender (In the format indicated in Section 3);

(b) Scanned copy of Earnest Money Deposit;

(c) Priced Bill of Quantities

(d) Scanned copies of Qualification Information as per formats given in Section 3;

and any other materials required to be completed and submitted by tenderers in accordance with these instructions. **The documents listed under Sections 3, 5 and 8 shall be filled in without exception.**

7. Tender prices

7.1 The contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Tenderer.

7.2 The Tenderer shall fill in rates and prices and line item total (both in figures and words) for all Items of the Works described in the Bill of Quantities along with total tender price (both in figures and words).

Items for which no rate or price is entered by the Tenderer will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the bill of Quantities. Corrections, if any, shall be made by crossing out, initialing, dating and rewrite.

7.3 All Duties, taxes and other levies payable by the contractor under the contract, or for any other cause,shall be included in the rates, prices and total Tender price submitted by the Tenderer excluding GST, GST will be reimbursed at prevailing rates as applicable.

7.4 The rates and prices quoted by the Tenderer shall be fixed for the duration of the Contract and shall not be subject to adjustment on any account.

8. Tender validity

8.1 Tenders shall remain valid for a period not less than ninety days after the deadline date for tender submission specified in Clause

12. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.

8.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the tenderers may extend the period of validity for a specified additional period. The request and the tenderers' responses shall be made in writing or by cable. A tenderer may refuse the request without forfeiting his earnest money deposit. A tenderer agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 9 in all respects.

9. Earnest money deposit

9.1 The Tenderer shall furnish, as part of his tender, earnest money deposit in the amount as shown in column 4 of the Table of IFT for this particular work. The EMD shall be submitted to the KPPP portal on or before the time of submission mentioned in IFT. Photocopies of the documents should not be arised.

9.2 Instruments having fixed validity issued as earnest money deposit for the tender shall be valid for 45 days **beyond** the validity of the tender.

9.3 Any tender not accompanied by an acceptable earnest money deposit and not secured as indicated in Sub-Clauses 9.1 and 9.2 above shall be rejected by the Employer as non-responsive.

9.4 The earnest money deposit of unsuccessful Tenderers will be returned within 30 days of the end of the tender validity period specified in Sub-Clause 8.1.

9.5 The earnest money deposit of the successful Tenderer will be discharged when the Tenderer has signed the Agreement and furnished the required Performance Security.

9.6 The earnest money deposit may be forfeited:

(a) If the Tenderer withdraws the Tender after tender opening during the period of tender validity;

(b) If the Tenderer does not accept the correction of the Tender Price, pursuant to Clause 19; or

(c) In the case of a successful Tenderer, if the Tenderer fails within the specified time limit to
(i) Sign the Agreement; or
(ii) Furnish the required Security deposit

10. **Format and signing of Tender**

10.1 The completed bid comprising of documents indicated in Clause 6, should be uploaded by accessing **Karnataka Government** website https://kppp.karnataka.gov.in/ through‘**KPPP**” along with scanned copies of requisite certificates those are mentioned in different sections in the bid document and scanned copy of Bid Security/EMD in case it s provided in the form OTC, NEFT, Debit Card & Credit Card.

10.2 All the documents should be uploaded to the KPPP portal. Tenderer should take a print out of the declaration letter provided in the website on company letterhead and should sign, stamp and upload the same e-portal.

10.3 The tender shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the Tenderer, in which case such corrections shall be initialed by the person signing the Tender.

D. Submission of Tenders

11. Up-loading and Submission of Tenders

11.1 The Tenders should be uploaded only through KPPP portal. Tender should contain

A. Technical tender consisting of following:

a. All the Documents with required details in prescribed format: those are mentioned in different sections in the Tender. Form of Tender, Declaration statement regarding customs/excise duty exemption for materials/construction equipment brought to site as mentioned in section 2, etc., shall be downloaded, filled with required details, signed, scanned & uploaded to the KPPP website https://kppp.karnataka.gov.in/ on or before the time and date indicated in notification/section I IFT.

b. **Tender Security**: Tender security can be paid in the form of OTC, NEFT, DEBIT CARD, and CREDIT CARD

The above documents along with notarized copies of documentary evidences as indicated in Section-II ITT, Section – III Qualification information & Section IV Forms of Tender shall be scanned and uploaded to the website compulsorily, failing which tender will be rejected in view of incomplete bid documents and

B. **Financial Tender consisting of Bill of Quantities:**

The Tender shall down load the bill of quantities and key in the rates (in figures only) in the Bill of Quantities sheet and upload the same file on to the website on or before the time and date indicated in notification /section – I IFT.

Note:

1. URL of the website for tender submission through e-portal https://kppp.karnataka.gov.in/
2. The details related to submission of tenders, downloading/uploading of documents or other details are available in the help wizard, Vendor manual & FAQ of above website. The same is provided along with sample formats in Annexure-I of the Bid document for ready reference.

12. Deadline for submission of the Tenders

12.1 Tenders must be received by the Employer at the address specified above **no later than 16:00 hrs on 03.03.2026.** In the event of the specified date for the submission of tenders being declared a holiday for the Employer, the tenders will be received up to the appointed time on the next working day**.**

12.2 The Employer may extend the deadline for submission of tenders by issuing an amendment in accordance with Clause 5, in which case all rights and obligations of the Employer and the Tenderers

previously subject to the original deadline will then be subject to the new deadline.

13. Late Tenders

13.1 Any Tender received by the Employer after the deadline prescribed in Clause 12 will be returned unopened to the tender.

14. Modifications and Withdrawal of Tenders

14.1 Tenderers may modify and withdraw their tenders multiple numbers of times, until the deadline for submission of tenders by operating the relevant provision made in KPPP. If the tenderer withdraws the tender before the deadline for submission of tenders and later if he is interested to submit the tender once again, may do so within the stipulated date & time as mentioned in Clause 12. In this case within the stipulated date and time, the tenderer can once again submit the requisition to the officer inviting tenders for access to withdrawn tender document for resubmission. For this tenderer need not make any additional payment towards the cost of tender document. Communication of modification/withdrawal by other means will not be accepted.

14.2 Deleted

14.3 No tender may be modified after the deadline for submission of tenders.

14.4 Withdrawal or modification of a tender between the deadline for submission of tenders and the expiration of the original period of tender validity specified in Clause 8.1 above or as extended pursuant to Clause 8.2 may result in the forfeiture of the earnest money deposit pursuant to clause 9.

14.5 Tenders may only offer discounts for individual items by simply modifying the quoted unit price in the Bill of Quantities. Also, Tenderer may enter their overall discount, at specified location in the Bill of Quantities only, by submitting tender modifications in accordance with this clause. Communication of discount by other means will not be accepted.

E. Tender opening and evaluation

15. Tender Opening:

15.1 The Employer will open all the tenders received (except those received late), including modifications made pursuant to Clause 14, in the present of the Tenderers or their representatives who choose to attend at Date and time specified in Clause 12. In the event of the specified date of tender opening being declared a holiday for the employer, the tenders will be opened at the appointed time and location on the next working day.

15.2 WITHDRAWAL proposal submitted pursuant to clause 14 shall be read out first and their bids shall not be opened.

15.3 The tenderers names, the tender prices, the total amount of each tender, any discounts, Tender modifications and withdrawals, the presence or absence of earnest money deposit (amount, format and validity) the submission of qualification information and such other information as the Employer may consider appropriate will be announced by the employer at the opening. No tender shall be rejected

at tender opening except for the late Tenders pursuant to Clause 13. Tenders (and modifications) sent pursuant to Clause 14 that are not opened and read out at Tender opening will not be considered for further evaluation regardless of circumstances.

15.4 The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present in accordance with Sub-Clause 15.3.

16. Process to be confidential

16.1 Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the rejection of his Tender.

17. Clarification of Tenders

17.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders in accordance with Clause 19.

17.2 Subject to sub-clause 17.1, no Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing.

17.3 Any effort by the Tenderer to influence the Employer in the Employer’s Tender evaluation, Tender comparison or contract award decisions may result in the rejection of the Tenderers’ Tender.

18. Examination of Tenders and determination of responsiveness

18.1 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender (a) meets the eligibility criteria defined in Clause 2; (b) has been properly signed; (c) is accompanied by the required earnest money deposit and; (d) is substantially responsive to the requirements of the Tender documents.

18.2 A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the Employer’s rights or the Tenderers obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.

18.3 If a Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

19. Correction of errors

19.1 Tenders determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:

a. where there is a discrepancy between the rates in figures and in words, the lower of the two will govern 17: and

b. where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.

19.2 The amount stated in the tender will be adjusted by the employer in accordance with the above procedure for the correction of errors and, with the concurrence of the tenderer, shall be considered as binding upon the tenderer. If the tenderer does not accept the corrected amount the tender will be rejected, and the earnest money deposit may be forfeited in accordance with sub-clause 9.6 (b).

20. Evaluation and comparison of Tenders

20.1 The Employer will evaluate and compare only the tenders determined to be substantially responsive in accordance with clause 18.

20.2 In evaluating the tenders, the employer will determine for each tender the evaluated tender price by adjusting the tender price as follows:

a. Making any correction for errors pursuant to clause 19; and

b. Making appropriate adjustments to reflect discounts or other price modifications offered in accordance with sub clause 14.5

20.3 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors, which are in excess of the requirements of the tender documents or otherwise result in unsolicited benefits for the employer shall not be taken into account in tender evaluation.

20.4 If the tender of the successful tenderer is seriously unbalanced in relation to the Employer’s estimate of the cost of the work to be performed under the contract, the Employer may require the Tenderer to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 25.1 be increased at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful under the contract.

F. Award of Contract

21. Award criteria

21.1 Subject to Clause 23, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially

responsive to the Tender documents and who has offered the lowest evaluated Tender Price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Clause 2, and (b) qualified in accordance with the provisions of Clause 3.

22. Employer's right to accept any Tender and to reject any or all Tenders

22.1 Notwithstanding Clause 21, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

23. Notification of award and signing of Agreement

23.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

23.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause 24.

23.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be kept ready for signature of the successful Tenderer in the office of Employer within 30 days following the notification of award along with the Letter of Acceptance. Within 20 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

23.4 Upon the furnishing by the successful Tenderer of the Security deposit, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

24. Security deposit

24.1 Within 20 days of receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Security deposit in any of the forms given below for an amount equivalent to 5% of the Contract price plus additional security for unbalanced tenders in accordance with Clause 20.4 of ITT and Clause 37 of the Conditions of Contract. :

- Cash or Banker’s cheque/Demand draft,/Pay Order in favour of Chairman, BWSSB, from a Nationalized / Scheduled Indian Bank Payable at Bangalore
- A bank guarantee from a Nationalized / Scheduled Indian Bank in the form given in Section 10; or
- Specified Small Savings Instruments pledged to BWSSB

24.2 The security deposit if furnished in cash or demand draft can, if requested, be converted to interest bearing securities at the cost of the contractor.

24.3 Failure of the successful Tenderer to comply with the requirements of Sub-Clause 25.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest money deposit.

25. Corrupt or Fraudulent practices

25.1 The GOK requires that the Tenderers/Suppliers/Contractors, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, GOK:

(a) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a GOK contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a GOK contract.

25.2 Furthermore, Tenderers shall be aware of the provision stated in sub-clause 43.2 of the Conditions of Contract.

SECTION 3:
FORMS OF TENDER, AND QUALIFICATION INFORMATION

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- **AGREEMENT FORM** **23-24**

Form of Tender

[Tenderer shall down load this page, print on the letter head, fill the gaps with signature, scan the sheet & upload to the website. Failing which the tender will be treated as non-responsive]

Description of the Works: work of providing and laying of various dia DI/MS line inplace of old CI line at Hosahalli uru, Hosahalli colony Vijayanagar RPC layout & surrounding area coming under Hosahalli Service station of AEEW-1-1 sub division

To,

The Executive Engineer,(West)-1
Bangalore Water Supply and Sewerage Board,
9th main, 5th cross, Vijaynagar, 2nd stage, RPC Layout,
Bangalore- 560040

Sir,

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying this Tender for the Contract Price of _____(In figures) (_____) (In letters).

This Tender and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Tender you receive.

We undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely “Prevention of Corruption Act 1988”.

We hereby confirm that this Tender complies with the Tender validity and Earnest money deposit required by the Tenderer documents.

We attach herewith our current income-tax clearance certificate.

Yours faithfully,

Authorize Signature:_____

Name & Title of Signatory:_____

Name of Tenderer:_____

Address:_____

To be filled in by the Tenderer, together with is particulars and date of submission at the bottom of the Form of Tender

Qualification Information

The Following form is to be downloaded, particulars are to be filled, scanned and uploaded by the Bidder, to **website:** https://kppp.karnataka.gov.in/ along with the Bid.

Note: The detailed procedure for downloading/uploading the documents will be available in Help Wizard, Vendor manual & FAQ of the above mentioned website.

The information to be filled in by the Tenderer hereunder will be used for purposes of computing Tender capacity as provided for in Clause 3 of the Instructions to Tenderers. This information will not be incorporated in the Contract.

1.1 Constitution or legal status of Tenderer [Attach copy] (Attach Copy)

Place of Registration _____ (Attach Copy)

Principal place of business: _____

1.2 Total value of civil engineering construction Works executed and payments received in the last five years (in Rs. Lakhs)[1]

2020-21_____
2021-22_____
2022-23_____
2023-24_____
2024-25_____

1.3 Information on works for which Tenders have been submitted and works which are yet to be completed as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of work	Place & State	Contract No. & Date	Name & Address of Employer	Value of Contract (Rs. Lakhs)	Stipulated period Completion	Value of Works remaining to be complete (Rs. Lakhs)	Anticipated Date of Completion
1	2	3	4	5	6	7	8

(B) Works for which Tenders already submitted:

Description of work	Place & State	Name & Address of Employer	Estimated Value of Works (Rs.	Stipulated Date period of Completion	Date When decision is expecte	Remarks if any

[1] Attach Certificate from Chartered Accountant

			Lakhs)		d	
1	2	3	4	5	6	7

1.4 Name, address, and telephone, telex, and fax numbers of the Tenderers' bankers who may provide references if contacted by the Employer.

Letter of Acceptance

To:_____

(Name and Address of the Contractor)

Dear Sirs,

This is to notify you that your Tender dated_____for execution of the _____(name of the contract and identification number, as given in the instructions to Tenderers) for the Contract Price of Rupees_____(_____) (amount in works and figures), as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by your Agency.

You are hereby requested to furnish Security deposit, in the form detailed in Para 24.1 of ITT for an amount of Rs.....within 20 days of the receipt of this letter of acceptance valid upto 30 days from the date of expiry of Defects Liability Period i.e. upto.....and sign the contract, failing which action as stated in Para 24.3 of ITT will be taken.

Yours faithfully,

Authorized Signature
Name and Title of Signatory
Name of the Agency.

`

.....

Issue of Notice to proceed with the work

To

_____(name and address of the Contractor)

Dear Sirs:

Pursuant to your furnishing the requisite security deposit as stipulated in ITT Clause 25.1 and signing of the contract agreement for the construction of ----------(Name of the Contract) a Tender Price of Rs....., you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

Agreement Form

Agreement

This agreement, made the _____day of _____20_____,
between_____
[name and address of Employer] (hereinafter called “the Employer”) of the one part and
_____
_____[name and address of contractor] (hereinafter called “the Contractor”) of the other part.
Whereas the Employer is desirous that the Contractor execute _____
_____[name and identification number of Contract] (hereinafter called “the Works”) and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein at a contract price of Rupees.....

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz:
   i) Letter of Acceptance;
   ii) Notice to proceed with the works;

iii) Contractor's Tender;
iv) Contract Data;
v) Conditions of contract (including Special Conditions of Contract);
vi) Specifications;
vii) Drawings;
viii) Bill of Quantities; and
ix) Any other document listed in the Contract Data as forming part of the contract.

Whereas, the parties now mutually agree to the following conditions of Contract.

1. Jurisdiction of Courts/Arbitration: The Sitting of arbitration shall be held at Bangalore only and nowhere else.
2. Dispute of any kind arising out of the contract shall be resolved within the jurisdiction of Bangalore city only and the parties agree and clearly understand that the courts/ tribunals situated at Bangalore Metropolitan City have exclusive jurisdiction for the redressal of the disputes arising out of the contract and at no other place.
3. The parties further agree and understand that the place or places of issue of bank guarantee other than Bangalore will have no jurisdiction to resolve dispute of any kind relating to enforcement of the bank guarantees submitted by the contractor at Bangalore for the execution of the contract at Bangalore.
4. The contractor shall comply with all the legal requirements in the matter of employment of workmen and provide all safety gadgets to the workmen while working in the hazards place of conditions during the execution of the contract.
5. Contractor shall be fully responsible in the event of death of employee/ workman during the execution of the work and liable to pay adequate compensation to the dependants of employee/ workman as per law.
6. On his/ their failure, if the Board is made to pay compensation the same shall be recovered by the Board from the contractor out of the amounts due to the contractor or by appropriate legal action.

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the presence of:
Signed, Sealed and Delivered by the said _____
_____
in the presence of:
Binding Signature of Employer _____
_____
Binding Signature of Contractor _____

SECTION 4: CONDITIONS OF CONTRACT

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Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Bold letters are used to identify defined terms.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Tender.

Compensation events are those defined in Clause 38 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Employer in accordance with Sub Clause38.1.
The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.3 below.
The **Contract Data** defines the documents and other information which comprise the Contract.
The **Contractor** is a person or corporate body whose Tender to carry out the Works has been accepted by the Employer.
The **Contractor's Tender** is the completed Tender document submitted by the Contractor to the Employer.
The **Contract price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.
Days are calendar days; **months** are calendar months.
A **Defect** is any part of the Works not completed in accordance with the Contract.
The **Defects liability period** is the period named in the Contract Data and calculated from the Completion Date.
The **Employer** is the party who will employ the Contractor to carry out the Works.
Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.
The **Initial Contract price** is the Contract Price listed in the Employer's Letter of Acceptance.
The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Employer by issuing an extension of time.
Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.
Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.
The **Site** is the area defined as such in the Contract Data.
Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Employer.
The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.
A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.
A **Variation** is an instruction given by the Employer which varies the Works.
The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the

language of the Contract unless specifically defined. The Employer will provide instructions clarifying queries about the Conditions of Contract.

2.2 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement
(2) Letter of Acceptance, notice to proceed with the works
(3) Contractor’s Tender
(4) Contract Data
(5) Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) any other document listed in the Contract Data as forming part of the Contract.

3. Law governing contract

3.1 The law governing the Contract is the Laws of India supplanted by the Karnataka Local Acts.

4. Employer's decisions

4.1 Except where otherwise specifically stated, the Employer will decide contractual matters between the Employer and the Contractor.

5. Delegation

5.1 The Employer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Subcontracting

7.1 The Contractor may subcontract with the approval of the Employer but may not assign the Contract without the approval of the Employer in writing. Subcontracting does not alter the Contractor's obligations.

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer.

9. Personnel

9.1 The Contractor shall employ the technical personnel (of number and qualifications) as may be stipulated by GOK from time to time during the execution of the work. The technical staff so employed shall be available at site as may be stipulated by the Employer.

9.2 If the Employer asks the Contractor to remove a person who is a member of the Contractor’s staff or his work force stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer’s and Contractor's risks

10.1 The Employer carries the risks which this Contract states are Employer’s risks, and the Contractor carries the risks which this Contract states are Contractor’s risks.

11. Employer's risks

11.1 The Employer is responsible for the excepted risks which are
(a) in so far as rebellion, riot commotion or disorder or
(b) a cause due solely to the design of the Works, other than the Contractor's design.
(C) Any Operation of the forces of nature (in so far as it occurs on the site) which an experienced contractor:

i. Could not have reasonably foreseen; or
ii. Could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:

a. Prevent loss or damage to physical property from occurring by taking appropriates measures or
b. Insure against such loss or damage

12. Contractor's risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Queries about the Contract Data

13.1 The Employer will clarify queries on the Contract Data.

14. Contractor to construct the Works

14.1 The Contractor shall construct the Works in accordance with the Specification and Drawings.

15. The Works to be completed by the Intended Completion Date

15.1 The Contractor may commence execution of the Works on the Start Date and complete them by the Intended Completion Date.

16. Safety

16.1 The Contractor shall be responsible for the safety of all activities on the Site.

17. Discoveries

17.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Employer of such discoveries and carry out the Employer's instructions for dealing with them.

18. Possession of the Site

18.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

19. Access to the Site

19.1 The Contractor shall allow the Employer and any person authorized by the Employer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured/fabricated/assembled for the works.

20. Instructions.

20.1 The Contractor shall carry out all instructions of the Employer which comply with the applicable laws where the Site is located.

B. Time Control

21. Program.

21.1 Within the time stated in the Contract Data the Contractor shall submit to the Employer for approval a Program showing the general methods, arrangement, order, and timing for all the activities in the Works.

21.2. The Employer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Employer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

22. Extension of the Intended Completion Date

22.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which make it impossible for Completion to be achieved by the Intended Completion Date.

22.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information.

23. Delays ordered by the Employer

23.1 The Employer may instruct the Contractor to delay the start or progress of any activity within the Works.

24. Management meetings.

24.1 The Employer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the progress achieved and the plans for remaining work.

24.2 The responsibility of the parties for actions to be taken is to be decided by the Employer either at the management meeting or after the management meeting and stated in writing to be distributed to all who attended the meeting.

1 **C.Quality Control**

25. Identifying defects:

25.1 The Employer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Employer may instruct the Contractor to search for a Defect and to uncover and test any work that the Employer considers may have a Defect.

26. Tests

26.1 The Employer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

27. Correction of defects

27.1 The Employer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for a long as Defects remain to be corrected.

27.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Employer's notice.

28. Uncorrected defects

28.1 If the Contractor has not corrected a Defect within the time specified in the Employer's notice, the Employer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

29. Bill of Quantities (BOQ)

29.1 The BOQ shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

29.2 The BOQ is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the BOQ for each item.

30. Variations

30.1 The Employer shall have power to order the Contractor to do any or all of the following as considered necessary or advisable during the progress of the work by him.

(a) Increase or decrease of any item of work included in the Bill of Quantities (BOQ):

(b) Omit any item of work:

(c) Change the character or quality or kind of any item of work

(d) Change the levels, lines, positions and dimensions of any part of the work:

(e) Execute additional items of work of any kind necessary for the completion of the works; and

(f) Change in any specified sequence, methods or timing of construction of any part of the work.

30.2 The Contractor shall be bound to carry out the work in accordance with any instructions in this connection, which may be given to him in writing by the Employer and such alteration shall not vitiate or invalidate the contract**.**

30.3 Variations shall not be made by the Contractor without an order in writing by the Employer, provided that no order in writing shall be required for increase or decrease in the quantity of an item appearing in the BOQ so long as the work executed conforms to the approved drawing.

30.4 The Contractor shall promptly request in writing the Employer to confirm verbal orders and if no such confirmation is received within 15 days of request, it shall be deemed to be an order in writing by the Employer.

31. Payments for Variations

31.1 Payment for increase in the quantities of an item in the BOQ up to 25% of that provided in the Bill of Quantities shall be made at the rates quoted by the Contractor.

31.2 For quantities in excess of 125% of the tendered quantity of an items given in the BOQ the Contractor shall be paid at the rate entered in or derived from in the Schedule of Rates (applicable for the area of the

work and current at the time of award of contract) plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract.

31.3 If there is no rate for the additional, substituted or altered item of the work in the BOQ, efforts would be made to derive the rates from those given in the BOQ or the Schedule of Rates (Applicable for the area of the work and current at the time of award of contract) and if found feasible the payment would be made at the derived rates for the item plus or minus the overall percentage of the original tendered rates over the current Schedule of Rat6es prevalent at the time of award of contract.

31.4 If the rates for additional, substituted or altered item of work cannot be determined either as at 31.1 or 31.2 or 31.3 above, the Contractor shall be requested to submit his quotation for the items supported by analysis of the rate or rates claimed, within 7 days.

31.5 If the Contractor's quotation is determined unreasonable, the Employer may order the Variation and make a change to the Contract Price which shall be based on Employer's own forecast of the effects of the Variation on the Contractor's costs.

31.6 If the Employer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

31.7 Under no circumstances the Contractor shall suspend the work on the plea of non-settlement of rates for items falling under this Clause.

32. Submission of bills for payment

32.1 The Contractor shall submit to the Employer monthly bills of the value of the work completed less the cumulative amount paid previously.

32.2 The Employer shall check the Contractor's bill and determine the value of the work executed which shall comprise of (i) value of the quantities of the items in the BOQ completed and (ii) valuation of Variations and Compensation Events.

32.3 The Employer may exclude any item paid in a previous bill or reduce the proportion of any item previously paid in the light of later information.

33. Payments

33.1 Payments shall be adjusted for deductions for retention, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor the within 60 days of submission of bill.

33.2 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

34. Compensation events

34.1 The following are Compensation event unless they are caused by the Contractor:

(a). The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.

(b) The Employer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.

(C) The Employer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.

(d) The Employer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.

(e) The effect on the Contractor of any of the Employer's Risks.

(f) The Employer unreasonably, delays issuing a Certificate of Completion.

(g) Other Compensation Event listed in the Contract Data or mentioned in the Contract.

34.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Employer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

34.3 As soon as information demonstrating the effect of each Compensation event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Employer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Employer shall adjust the Contract Price based on Employer's own forecast. The Employer will assume that the Contractor will react competently and promptly to the event.

34.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interest is adversely affected by the Contractor not having given early warning or not having cooperated with the Employer.

35. Tax

35.1 All Duties, taxes and other levies payable by the contractor under the contract, or for any other cause,shall be included in the rates, prices and total Tender price submitted by the Tenderer excluding GST, GST will be reimbursed at prevailing rates as applicable.The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

36. Liquidated damages

36.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Dates later than the Intended Completion Date. The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor; Payment of liquidated damages does not affect the Contractor's liabilities.

36.2 If the Intended Completion Dates extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

37. Cost of repairs

37.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

38. Completion

38.1 The Contractor shall request the Employer to issue a Certificate of Completion of the Works and the Employer will do so upon deciding that the Work is completed.

39. Taking over

39.1 The Employer shall take over the Site and the Works within seven days of issuing a certificate of Completion.

40. Final account

40.1 The Contractor shall supply to the Employer a detailed account of the total amount that the Contractor considers payable under the Contact before the end of the Defects Liability Period. The Employer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 90 days of receiving the Contractor's account if it is correct and complete, If it is not, the Employer shall issue within 90 days a Schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Employer shall decide on the amount payable to the Contractor and make payment within 60 days of receiving the Contractor's revised account.

41. As built drawings

41.1 If "as built" Drawings are required, the Contactor shall supply them by the dates stated in the Contract Data.

41.2 If the Contractor does not supply the Drawings by the dates stated in the Contract Data, or they do not receive the Employer's approval, the Employer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

42. Termination

42.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

42.2 Fundamental breaches of Contract include, but shall not be limited to the following:

a) The Contractor stops work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer.

b) The Employer instructs the Contractor to delay the progress of the Works and the instruction is not withdrawn within 60 days.

c) The Contractor becomes bankrupt or goes into liquidation other than for a reconstruction or amalgamation:

d) A payment due to the Contractor is not paid by the Employer within 90 days of the date of the submission of the Bill by Contractor:

e) The Employer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Employer;

f) The Contractor does not maintain a security which is required:

g) The Contractor has delayed the completion of works by the number o days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

h) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.

For the purpose of this paragraph:"corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of acts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition".

42.3 When either party to the Contract gives notice of a breach of contract to the Employer for a cause other than those listed under Sub-Clause 42.3 above, the Employer shall decide whether the breach is fundamental or not.

42.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

42.5 If the Contract is terminated the Contractor shall stop work immediately, take the Site safe and secure and leave the Site as soon as reasonably possible.

43. Payment upon Termination

43.1 If the Contract is terminated because of a fundamental breach of contract by the Contractor, the Employer shall prepare bill for the value of the work done less advance payments received up to the date of the bill, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

43.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Employer shall prepare ill for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and Contractor's costs of protecting and securing the Works and less advance payments received upto the dateof the certificate, less other recoveries due in terms of the contract, and less taxes due to be deducted at source as per applicable law and make payment accordingly.

44. Property.

44.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor's default.

45. Release from performance

45.1 If the Contractor is frustrated by any event entirely outside the control of either the Employer or the Contractor the Employer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate

and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made.

F.Special Conditions of Contract

1. Labour:

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment,. Housing, feeding and transport.

The Contractor shall, if required by the Employer, deliver to the Employer a return in detail, in such form and at such intervals as the Employer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Employer may require.

2. Compliance with labour regulations:

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amount as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, Employer shall have the right to deduct any money due to the Contractor including his amount of security deposit. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

3. Protection of Environment:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

[Add other clauses specific to the works for which tenders are invited]

4. Arbitration (Clause 24)

4.1 Deleted

5 Contractor to Co-ordinate his Work with Other Contractors

5.1 Deleted.

6 **Continuation of Work:**

6.1 Deleted

7. The surface road cut :

The surface cut of the road (pavement) has to be made by "Machine Cut" only

SECTION5: CONTRACT DATA

Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract: Clause Reference

The Employer is : Executive Engineer, West-1 Division. [1.1]

Address : BWSSB, 9th main 5th cross
Vijaynagar 2nd stage, Bangalore-560040.

Name of authorized Representative: Executive Engineer, West-1 Division
BWSSB, 9th main 5th cross
Vijaynagar 2nd stage, Bangalore-560040

The name and identification number of the contract is: **work of providing and laying of various dia DI/MS line inplace of old CI line at Hosahalli uru, Hosahalli colony Vijayanagar RPC layout & surrounding area coming under Hosahalli Service station of AEEW-1-1 sub division.**

The Works consist of: work of providing and laying of various dia DI/MS line inplace of old CI line

The start date shall be the date of issue of notice to proceed with the work [1.1]

The Intended Completion Date for the whole of the Works is 3 Months [15,22]

The following documents also form part of the Contract: [2.2]

The Site Possession Date is: 15 days from date of issue of notice to proceed with the work. [18]

The Site is located at: **from Hosahalli uru, Hosahalli colony Vijayanagar RPC layout** [1.1]

The Defects Liability Period is 365 days [27]

The liquidated damages for the whole of the works are Rs.0.1% per day [36]

The maximum amount of liquidated damages for the whole of the work [36]

is ten percent of final contract price.

The date by which “as-built” 22drawings (in scale …) in 2 sets are required is within 30 days of issue of certificate of completion .. [41]

The amount to be withheld for failing to supply “as built”23 drawings by the date required is Rs._50,000/-___ [41]

The following events shall also be fundamental breach of the contract: [42.2]

1. The contractor has contravened Sub-clause 7.1 and Clause 9 of CC.

The percentage to apply to the value of the work not completed representing the [43.1]

Employer’s additional cost for completing the works shall be 30 percent.

EEW-1

SECTION 6: SPECIFICATIONS

TECHNICAL SPECIFICATIONS

I GENERAL

1.1 Scope of Work.

The scope of work under this Contract includes the following:

1.1.1 Providing & Laying of 100mm dia DI pipes with linking.

1.12 Earthwork in all kinds of soil. The pipeline is to be laid in the developed city roads with traffic.

1.1.3 Fixing and connecting all pipelines fixtures like valves, bends, tees and other specials as specified in the construction drawings, construction all appurtenant structures such as pipe supports, etc.,

1.1.4 Testing and commissioning of the pipe line after laying.

1.1.5 Maintenance of all the pipelines for 12 months after commissioning. During this period, the contractor has to set right the defect of any kind in the manufacture,

laying and jointing of all the pipelines and in the other works in this scope of tender.

1.1.6 All work shall be done as per the specifications. The works shall include providing all materials, equipments, labour, tools, plants, transport etc., and all other services necessary for the complete construction including necessary sub-soil investigations.

1.1.7 The alignment of the pipeline and other typical details of pipe bedding, valve chambers, thrust blocks, pipe supports, and the general arrangement of reservoir are furnished in Drawings. Further details shall be furnished in the construction drawings during the construction stage if found necessary.

1.2 Royalties

1.2.1 The Employer shall deduct Royalties on materials used in the Works from the progress payments to the Contractor at the rates specified in the most recent "Amendment to the Karnataka Minor Minerals Concession Rules - 1969" as published by the Commerce and Industries Department (Mines) and as illustrated in Annexure-1, attached.

1.3 Site Order Book

1.3.1 The Contractor shall maintain an identical pair of Site Order Books (one marked original and the other marked duplicate), at the Site at all times during the execution of the Works for the use of the Engineer and the Contractor. All instructions issued by the Engineer to the Contractor shall be recorded in both sets of the Site Order Book and shall be signed by the issuer and countersigned by the Contractor. After compliance with the instruction, the Contractor shall record the same in both sets of the Site Order Book duly signed and countersigned by the Engineer. Acceptance of any part of the work executed by the Contractor shall be subject to verification with respect to compliance of respective instructions of the Engineer through the Site Order Book. The Engineer shall retain the original copy of the Site Order Book, while the Contractor shall retain the duplicate one.

1.4 Quarry Materials

1.4.1 The Contractor shall be wholly responsible to identify the suitable sources for quarry materials required for the Works, such as earth, sand, stone, muram, etc., and to make his own arrangements for collection and transportation of the materials irrespective of the leads and lifts required. The quarry thus identified by the Contractor should have proper license from the Government of Karnataka. All materials supplied by the Contractor shall satisfy the requirements set forth in the Specifications and shall be subject to the approval of the Engineer. The Contractor shall take this into account while offering his rates and no claims whatsoever shall be entertained for extra costs on this account.

1.5 Inspection and testing

1.5.1 Inspection of Material to be procured

Inspection and certification of all materials used on the works such as MS Plates / Pipes and Specials , Valves, Cement, Size Stones, Sand aggregate, Lead, Rubber gaskets etc., for conformity with specifications of BIS. If insisted, inspection of materials at the manufacture place shall be arranged by the

contractor at his cost including the travelling and accommodation of the inspecting officer.

1.5.2 **Inspection and certification of the various components of works.**

Construction of pipeline with all fixtures, construction of Valve Chamber including back filling of trench in layers with compaction as specified to ensure that all components of works are carried out as per specification and to required standards.

Inspection & Certification of Hydraulic Test on Completed pipe line in reaches as specified.

1.6 Technical Specifications

1.6.1 Engineer shall have the right to modify/alter the Particular Specifications and/or Standard Specifications at any time which promise to confer equal or better quality than the standard specified in the tender document. Such modification or alteration shall be acceptable to the Contractor subject to no additional financial burden to either the Contractor or the Employer.

1.7 Storage of Materials and Plant

1.7.1 The Contractor shall provide appropriate storage facilities for materials like cement, steel, aggregates, consumable supplies, equipment, mechanical and electrical items, etc., and shall take all safety and security measures against theft and deterioration in quality, at his own cost.

1.8 Procurement of Materials:

1.8.1 CEMENT:

The Contractor shall use only 43 grade cement conforming to IS 8112 / 89 with latest amendments with ISI mark. The Contractor should furnish the manufacturer test certificate for the above brand of cement for having manufactured the cement as per relevant BIS and guarantee certificate before using the cement.

1.8.2 STEEL:

The Contractor shall procure the steel from VISL / SAIL / VSP / TISCO and manufacturers' test certificate is to be produced.

1.8.3. MS PIPES, VALVES AND OTHERS

Sl.No.	Description	Make
	Sluice Valves Conforming to IS 14846/2000	KIRLOSKAR, IVI, FOURESS, DURGA, JASH, JUPITER, BSJ, SHAU, UPADYAYA, CALSEN
	Butterfly valves – Conforming to IS 13095 / 1991	KIRLOSKAR, FOURESS, IVI, DURGA , L & T, JASH
	MS plate/HR coil to Manufacture MS pipes Conforming to IS: 2062	SAIL, TISCO,ESSAR STEEL, ISPAT Industries,
	Kinetic Air Valves	KIRLOSKAR, IVI, BSJ, SHAU, DURGA,

		CALSEN,
	Double Ball Kinetic Air Valves	KIRLOSKAR, IVI, BSJ, SHAU, DURGA
	Bolts, Nuts and Washers	GKW, TEXSO MAKE, T.V.S. UNBRAKO

(Any other reputed make as may be approved by BWSSB at a later date by producing the credentials.)

The above branded makes are preferred. In the bid the bidder should specify the make for which the rate is quoted without which the Board can specify any make among the above brands

1.9 Equivalency of Standards and be procured, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be acceptable subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

1.10 Sign Board

1.10.1 The Contractor shall provide a sign board at the site of the Works of approved size and design which provides (i) the name of the Project (ii) the names and addresses of the Employer, the Contractor and the Consultant; (iii) the name and short description of the Project, (iv) the amount of the Contract Price ; and (v) the starting and completion dates.

1.11 Samples and Tests

1.11.1 The Contractor shall be responsible to develop a quality control program and to provide all necessary materials, apparatus, instruments, equipment, facilities and qualified staff for sampling, testing and quality control of the materials and the works under the Contract. Without limiting the generality of the foregoing, the Contractor shall either (i) establish a testing laboratory at the site of Works which is adequately equipped and staffed to carry out all sampling and testing in accordance with the requirement set out in the General Specifications and/or these Special Specifications and provide all field equipment and apparatus as necessary to conduct all specified in-situ tests and/or any Tests on Completion, provided the correctness of the equipments are ensured or (ii) arrange for routine sampling, testing and reporting, as required, through a certified independent testing laboratory acceptable to the Engineer. All costs of such sampling, testing and reporting of test results will be borne by the Contractor, and the Contractor shall include sufficient provisions in his tendered rates to allow for independent sampling and laboratory testing under the direction of the Engineer up to 5% of the required tests at no additional cost. The Contractor shall furnish certified copies of all test reports to the Engineer within 3 days of completion of the specified tests.

1.11.2 The Contractor shall, within 14 days after the date of the Letter of Acceptance, submit to the Engineer for his consent a detailed description of the arrangements for conducting the quality control programme during execution of the Works, including details of his testing laboratory, equipment, staff and general

procedures. If following submission, or at any time during the progress of Works, it appears to the Engineer that the Contractor's quality control programme is not adequate to ensure the quality of the Works, the Contractor shall produce a revised programme which will be adequate to ensure satisfactory quality control.

1.12 Protection of Utilities

1.12.1 The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting or realignment of water, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer. In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the Karnataka Power Transmission Corporation Ltd. (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

II EARTH WORK:

2.1 GENERAL:

2.1.1 The earth work excavation for laying of pipe shall be carried out. The Contractor shall make all excavations required for laying and jointing of the pipeline and construction of pertinent structures as required in the project. Except where otherwise required by the project or instructed by the Engineer, all excavation shall be in open cut to the specified widths and depths. The Contractor is advised to satisfy himself with regard to the likely conditions that may be met with during the execution of the Works, with regard to the underground obstructions or conditions, necessary dewatering requirements etc. Before commencing the earth work, the Contractor shall carry out detailed survey of the proposed alignment, prepare construction drawings showing the longitudinal section of the ground profile, locations of valves and other appurtenances and submit to the Employer for approval.

2.2 CLASSIFICATION OF EXCAVATION

All materials involved in excavation shall be classified in three categories as follows:

2.2.1 **Ordinary soil:** This includes excavation in all types of soil including soil containing gravels, murums, loose boulders, viz., ordinary gravely soil, hard gravely soil, wet soil, stiff slushy soil, chettu soil and calcareous strata, but exclusive of disintegrated rock, soft rock/shale;

2.2.2 **Soil Containing Disintegrated Rock, Soft Rock and Soft Shale:** This category includes excavation in soil containing disintegrated rock, soft rock or soft shale which can be cut by shovel and no hand or mechanical chiseling is required.

2.2.3 **Medium Hard Rock:** This category includes excavation in lime stone, sand stone, hard shale and schist fissured rock, without resorting to blasting.

2.2.4 **Hard Rock:** This category includes excavation in hard rock requiring hand or mechanical chiseling or blasting. In case of difference in opinion between the classification of rock requiring blasting and that requiring chiseling, wedging, the site of work shall be inspected by the engineer and the decision of the Engineer shall be final and binding on the Contractor.

2.3 LIMITATION OF EXCAVATION

2.3.1 The trench for laying MS Spiral welded pipes shall have minimum width as per standards stipulated or as directed by the Engineer-in-charge. A minimum earth cover of 1.2 m shall be maintained above the pipe top, unless otherwise specified or shown in the alignment drawings.

2.3.2 The Contractor shall be responsible to ensure that the widths and depths of the trenches do not exceed the limits shown in the construction drawings. Should the excavation occur beyond the dimensions specified therein, because of the negligence of the Contractor, the Contractor shall fill the excess space with granular material or concrete as directed by the Engineer. Nothing extra shall be paid to the Contractor on account of this.

2.4 TRAIL PITS

2.4.1 Trial pits may be dug by the Contractor, without being directed to do so, along the alignment as shown on the drawings in advance of the excavations for the purpose of satisfying himself as to the location of under ground obstructions or soil conditions.

2.5 SLIPS AND SLIDES

2.5.1 The Contractor is responsible for proper protection of excavations made by him from any slips and slides. All slides and caving shall be handled, removed or corrected by the Contractor without any extra compensation at whatever time and under whatever circumstances they may occur. The excavations shall be made good and brought to necessary depth, width and levels without any extra cost.

2.6 STCKING OF EXCAVATED MATERIALS

2.6.1 The excavated material shall be stacked on the sides of the trench wherever possible. Wherever it is not possible to stock on the sides of the trench, contractor has to find the place nearby for stocking the excavated material and cart the materials to & fro. Rate for this shall be included in the earthwork itself and no extra rate will be paid for this.

2.6.2 Surplus earth is to be disposed off to a place identified by the contractor approved by the engineer. There is a item for this work and will be paid accordingly.

2.7 Safety measures

The Contractor shall provide adequate safety measures during excavation. They shall include:

1. Barricading all sides of the open trenches.
2. Red danger lights which can be easily visible from dusk to dawn placed at an interval of 20 m.
3. Traffic signals and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.
4. Adequate safe wooden plank / board or steel plate over the trenches to facilitate crossing by the public residing on either side of the trench.
5. Round the clock watch and ward maintaining all safety regulations at the site of work and protecting the site from unauthorised intrusions.

2.8 Progress of Excavation of pipe trenches

The Contractor shall adjust excavation of trenches in such lengths that the pipes can be laid in such exposed portion of the trench within 2 days.

2.9 Shoring and Bracing

The Contractor shall supply, fix and maintain necessary sheathing, shoring and bracing etc., in steel or wood, as may be required to support the sides of the excavation, to protect workmen in the trench and to prevent any trench movement which might any way injure or delay the work, change the required width of the trench, make unsafe condition for adjacent pavements, utilities, buildings or other structures above or below ground.

Sheathing, shoring and bracing shall be withdrawn and removed as the backfilling is being done, except when the Engineer may agree that such sheathing, shoring and bracing be left in place, at the Contractor’s request. In any case, the Contractor shall cut off any such sheathing at least 600 mm below the surface and shall remove the cut off material from the trench.

All sheathing, shoring and bracing which are left in place under the foregoing provisions shall be removed in a manner so as to not endanger the completed work or other structures, utilities or property, whether public or private.

2.10 EXCAVATION

2.10.1 Excavation in Rock

Excavation in rock shall be carried out to a depth, 150 mm more than the bottom level of pipe and to a width equal to the diameter of the pipe plus minimum working space on either side as given in drawing. Unless otherwise directed by the Engineer, rock excavation shall be progressed at least by 50 m in advance of the pipe length proposed to be laid.

2.10.3 Excavation for Valve Chambers and Other Appurtenant Structures

The Contractor shall excavate as required for all structures with foundations to firm, undisturbed earth up to the level of the under side of the structure. If the excavation is in rock, the Contractor shall excavate all rock at least to the minimum limits shown on the standard details for trenches and to the grade of the bottom of inlets, junction chambers or other structures as required. Where the bottom of the structure is in rock, it should be ensured that no rock shall project above the lower surface of the concrete in such a manner so as to reduce the required thickness of concrete placed simultaneously as an integral part of the foundation and to the outside of structure foundation where structure is to be built. The Contractor shall excavate the trench / pit to provide

necessary working space on all sides and for accommodating any sheathing, shoring or bracing etc.

2.11 Contractor's Responsibility

The Contractor shall be responsible for the adequate pumping, drainage and bailing out water from the excavated trench. In case of failure to make such provisions or any other provisions which may result in unsuitable sub-grade conditions, the Contractor shall replace and repair the sub-grade as directed to the satisfaction of the Engineer, at his own cost and responsibility.

Should the Contractor select to use a gravel sub-grade to facilitate flow of water to pumps or other points of disposal, such gravel sub-grade shall not be measured or paid for as an extra item.

2.12 Works Included in Excavation

The following works as per specifications are also included in excavation and the term 'Excavation' shall construe to mean all such items of work. The quoted rates should include the same:

1. Provision of side space or additional space in the trench/pit for working and/or accommodating sheathing, shoring, bracing, etc.
2. Supply, installation and removal after the work, all sheathing, shoring and bracing required to protect the excavation where required or where such work is recommended by the Engineer.
3. Protection of excavations.
4. Providing adequate safety measures.
5. Additional work in connection with overhead wires and poles.
6. Excavation for Socket hallows.
7. Supplying and fixing of sight rails and boning rods in the trench to facilitate measurement of work.

2.13 Measurement and Payment for Excavation

2.13.1 For Excavation

The measurement for excavation shall be considering the allowable widths, depths with allowed side slopes (if any) for different classes of soils as per approved classification. The measurement for excavation shall be based on "neat line" dimensions as specified in the drawing or Specifications, for different types of soils and depth of excavation. The total volume of excavation shall be computed as a square bottomed trench of width equal to the outer diameter of the pipe, with minimum working space as given in the drawing, added to it, length up to the length of the trench being measured. The depth of trench being average depth taken at 30 m intervals, between the level of bottom of trench and the original surface of the ground. The length of the trench shall be measured as per the actual length of pipes and fittings / specials laid at work site. However depth shall be measured at closure intervals at vulnerable places. The volume of excavation for structures like valve chambers, thrust blocks and anchor blocks etc., shall be computed and measured for payment as per the bottom area of the particular structure on outer periphery multiplied by the average depth between the level of the finished bottom of the structure and the original surface of the ground. The quantity shall be measured in cubic meters correct to two decimal places. The method of measurement for excavation in different classes of soils shall be as follows:

2.13.2 In Ordinary Soil and Soil Mixed with Disintegrated Rock and Soft Rock / Shale

In this category of soils, the excavation quantity shall be computed as specified above.

2.13.3 In Hard rock

In case of hard rock requiring chipping or chiseling, measurements shall be taken prior to and after chiseling and the volume of rock excavation shall be measured based on this difference. The excavation in rock shall be paid on stack measurements with a deduction of 40% in volume for voids.

2.13.4 For Excavation in Combination of Ordinary Soil, Disintegrated Rock, Soft Rock/Shale and Hard Rock/Schist

Wherever the excavation is undertaken in combination of ordinary soil, disintegrated rock, soft rock /shale and hard rock, the hard rock part shall be measured and paid, the soil part shall be measured and paid for the total measurable excavated quantity deducting the quantity measured for the hard rock. The total computed volume of excavation shall be equal to the sum of the computed volumes for each category of excavation undertaken.

2.14 Protection of Utilities

The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting or realignment of water, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer.

In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the Karnataka Power Transmission Corporation Ltd. (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

III. BEDDING.

3.1. Bedding for the pipe

Bedding shall be provided all along the stretch of the pipe line, which differs based on the area through which the pipe line passes. However, the type of bedding to be provided shall be as decided by the Engineer.

3.2 Earth Bedding

The pipes shall be placed on the natural, undisturbed earth bedding, which has been carefully shaped to fit the lower part of the pipe for a width of at least 50

% of its external diameter. The trench shall be excavated to an extra breadth and depth, wherever weld joints are coming. Filling and removing earth or similar materials beneath the pipe to adjust with the grade will not be permitted except filling with compacted granular bedding material or murrum.

3.3 Gravel Bedding

Wherever rock is met with, it shall be removed up to 150 mm below the bottom level of the pipe to a minimum width equal to the width of the trench and the resulting space shall be filled up with good quality compacted gravel. The granular material shall be filled in the trench up to the level of ¼ the outer diameter of the pipe line, above the bottom of trench and well compacted. Unless otherwise directed by the Engineer, rock excavation shall progress at least 20 m in advance of the pipe length proposed to be laid.

3.4 Measurement for bedding:

The Contractor shall include the cost of earth bedding required for the pipeline in the tendered rate for pipe laying, for providing gravel bedding. The surplus quantity of excavated earth shall be disposed off. The quantity shall be measured in cubic meter correct to two decimal points.

IV BACK FILLING

4.1 General

The Contractor shall use selected surplus spoils from excavated materials for backfilling. All fill material shall be subject to Engineer’s approval. The excavated materials suitable for backfilling shall be stored not closer than 600 mm from the edge of the trench and shall not obstruct any public utilities or interfere with travel by local inhabitants or general public. Handling and storage of excavated materials must meet with the regulations of the Local Government Authorities. The detailed specifications for backfilling shall be as per Clause 8 of IS: 3114-1994 and Clause 4.11 of IS 12288-1987.

4.2 Method of Backfilling

Trenches and excavated pits for structures shall be backfilled to original ground level or to such other levels, as the Engineer may direct. All backfilling shall be carried out in orderly manner expeditiously and consistent with good workmanship.

4.2.1 Backfill material put into the trenches/pits for backfilling, shall unless otherwise specified be compacted and built up as to minimise future settlement as much as is reasonably possible. For this, care shall be exercised in selecting backfill material free from large hard clay lumps, especially in cramped areas directly adjoining the walls of structures.

4.2.2 Backfilling in trenches shall be done as pipe laying progresses, with the permission of the Engineer, after the pipe or conduit is properly bedded, jointed and inspected and all measurements for the location of Y-Junctions, tees, etc., are properly recorded by the Engineer and sufficient time is allowed for the joint materials or cement concrete or mortar to set. However the joints shall be left open for inspection during testing, which shall be backfilled after successful completion of testing, after obtaining permission from the Engineer. Backfilling around and over the pipe, conduit, or structure shall be taken up uniformly on all sides and in the sequence and manner specified hereinafter, with care to avoid the displacement or damage to the pipe, conduit or structure. For the

purpose of backfilling, the depth of trench shall be divided into the following three zones measured from bottom to top of trench, as follows:

i. Zone A : From bottom of trench to the centre line of pipe,
ii. Zone B : From the level of centre line of pipe to a level of 300 mm above the top of pipe,
iii. Zone C : From a level of 300 mm above the top of pipe to the top of trench.

4.2.3 Backfilling in the trenches and around structures shall be carried out in horizontal layers of uniform thickness of not more than 150 mm when measured loose. As may be necessary to attain maximum compaction, the backfill material shall be moistened by sprinkling with water. After placing each layer of backfill material, the layer shall be thoroughly and uniformly compacted by means of mechanical or hand tampers. The compacting equipment and the manner of its use shall be subject to the approval of the Engineer.

4.2.4 After the backfill material is placed in Zone A and Zone B as specified above, the remaining portion i.e., Zone C of the trench may be machine backfilled. Even in this case the backfill material shall be placed in uniform horizontal layers of not more than 150 mm thickness. Small pebbles of size less than 50 mm, if any, shall be so distributed throughout the mass, that all interstices are solidly filled with fine material. The backfill material shall be tamped with mechanical tamping equipment, after moistening the backfill by sprinkling with water to obtain maximum compaction (min 95% proctor density).

4.2.5 Machine backfill shall be so conducted that the material deposited in the trench shall not fall directly on top of the pipe from such a height as might result in damage to the pipe joints or alignment.

4.2.6 If the trench is subjected to conditions which might cause flotation of the pipe before sufficient backfill has been placed, the Contractor shall take the necessary precautions to prevent floatation of the pipe, conduit or structure.

4.2.7 Before final acceptance of the work, additional tamped earth shall be added to restore the settled trench surface to the required level of the adjacent earth surface or to the base of crushed rock wearing surface or to the finished earth base.

4.2.8 If from the excavated soil, enough backfill material is not available, imported, selected and approved backfill material from the borrow pits is required to be placed for backfill, on approval of the Engineer backfilling of trenches where the excavation is in the rock shall be with the surplus soft soil, with all lead and lift.

4.3 Disposal of Surplus Excavated Material

The excavated material which is in surplus to the requirements after backfilling shall be removed and spread at places shown by the Engineer, with all lead and lift from the site of work, for which payment shall be made as per the quoted rates. No surplus or excess material shall be disposed in a stream / channel or in any place where the pre-construction surface drainage may have to be provided, without written permission of the Engineer.

V DUCTILE IRON PIPELINE

5.1 Scope

This specification covers the requirements for manufacturing, supplying, laying, jointing, testing and commissioning of Ductile Iron pipeline and fittings including associated civil works required for the same.

5.2 Standards

The following specifications, standards, and codes are part of this specification. All standards, specifications and codes of practice referred herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern,

IS:8329 Centrifugally Cast (Spun) ductile Iron Pressure pipes for water, gas and sewage.
IS:638 Sheet rubber jointing and rubber insertion jointing.
IS:1387 General requirements for supply of metallurgical materials**.**
IS:1500 Methods for Brinell Hardness test for metallic materials.
IS:9523 Ductile Iron fittings for pressure pipes for water, gas and sewage.
IS:12820 Dimensional requirements of rubber gaskets for mechanical joints and push on joints for use with cast iron pipes and fittings for carrying water, gas and sewage.
ISO:4179 Ductile iron pipes for pressure and nonpressure – Centrifugal cement mortar lining – General requirements.
ISO:2531 Ductile iron pipes, fittings and accessories for pressure pipe lines.
IS:5382 Specification for Rubber Sealing rings for Gas mains, water mains and sewers.
AWWA C600 Installation of ductile iron water mains and their appuratenances.
IS:11906 Recommendations for cement-mortor lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water.
IS:3764 Excavation work – code of safety.
IS:12288 Code of practice for use & laying of Ductile iron pipes.
IS:460 Test sieves – Part I
IS:8112 Specification for 43 Grade Ordinary Portland Cement.
BS 3416 Bitumen based coatings for cold application, suitable for use in contact with potable water.
BS EN 545 Ductile iron pipes, fittings, accessories and their joints for water pipelines – requirements and test methods.
ISO 81790 For zinc coating.

5.3. Manufacture of pipe

DI pipes and fittings (Class K7 & K9) shall be in accordance with IS: 8329 and IS: 9523. Pipes and fittings shall be procured from reputed manufacturers with Engineer's approval. Engineer shall at all reasonable times have free access to the place where the Pipes and fittings are manufactured for the purpose of examining and testing the pipes and fittings and for witnessing the test and manufacturing.

All tests specified either in this specification or in the relevant Indian Standards specified above shall be performed by the Manufacturer / Contractor at his own cost and in presence of Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Engineer.

If the test is found unsatisfactory, Engineer may reject any or all pipes and fittings of that lot. The decision of Engineer in this matter shall be final and binding on the Contractor and not subject to any arbitration or appeal.

The pipes and fittings shall be stripped, with all precautions necessary to avoid warping or shrinking defects. The pipes and fittings shall be free from defects. Any defect in pipes and fittings in the opinion of Engineer shall be rejected and shall be replaced by new one.

In the case of spigot and socket pipes and fittings, the socket shall be without the centre ring.
In the case of flanged pipes, the flanges shall be at the right angles to the axis of the pipe and machined on face. The bolt holes shall be drilled and located symmetrically off the centre line. The bolt hole circle shall be concentric with the bore and bolt holes equally spaced. The flanges shall be integrally cast with the pipes and fittings and the two flanges of the pipe shall be correctly aligned.

a). Materials

The materials used in the manufacture of pipes and fittings shall comply with requirements specified in IS: 8329 - 2000 and IS: 9523 - 2000.

b). Dimensions and Tolerances

The internal diameter, thickness and length of barrel, dimensions of pipes and fittings shall be as per relevant tables of IS: 8329/IS: 9523 for different class of pipes and fittings. Pipe of standard length of 6m is recommended and other properties for pipes and fittings shall be as per IS: 8329/IS: 9523. Each pipe shall be of uniform thickness throughout its length.
The tolerances for pipes and fittings regarding dimensions, mass, ovality and deviations from straight line in case of pipes shall be as per IS: 8329/IS: 9523.

5.4 Testing

(a) **Mechanical tests**
Mechanical tests shall be carried out during manufacture of pipes and fittings as specified in IS: 8329/IS: 9523. The frequency and sampling of tests for each batch of pipes shall be in accordance with IS 8329. The tests results so obtained for all the pipes and fittings of different sizes shall be submitted to Engineer. The method for tensile tests and the minimum tensile strength requirement for pipes and fittings shall be as per IS: 8329/IS: 9523.

(b) Brinell Hardness Test

For checking the Brinell hardness, the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS 1500. The test shall comply with the requirements specified in IS 1500/IS 8329.

(c) **Retests**
If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the tests results satisfy the specified requirements, the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

(d) Hydrostatic Test

For hydrostatic test at works, the pipes and fittings shall be kept under test pressure as specified in IS 8329/IS9523 for a period of minimum 15 seconds, during which the pipes shall be struck moderately with a 700 g hammer for conformation of satisfactory sound. They shall with stand the pressure test without showing any leakage, sweating or other defect of any kind. The hydrostatic test shall be conducted before surface coating and lining.
During manufacture, tests on pipes shall be carried out in accordance with **clause 1.2.8 of this Technical specification** by the Third party inspecting agency.

5.5 Jointing of pipes

(a) General

Jointing of DI pipes and fittings shall be done as per IS: 12288 and manufacturer's recommendations. After jointing, extraneous material, if any, shall be removed from the inside of the pipe. Rubber sealing rings/gaskets used for jointing shall conform to IS: 638, IS: 12820 and IS: 5382.

(b) Spigot and Socket joints

These shall have sockets, which are integral with the pipe and incorporate an electrometric rubber ring gasket conforming to IS: 12820.
The gaskets/sealant used for joints shall be suitable for water conveyance. In jointing DI pipes and fittings, the Contractor shall take into account the manufacturer's recommendations as to the methods and equipment to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that the rubber ring as per IS: 12820 and IS: 5382 is correctly positioned in line, before the joint is made. The rubber rings and any recommended lubricant shall be obtained only through the approved supplier and as directed by the Engineer.

(c) Gaskets for Flanges

All gaskets used between flanges of pipes shall be of natural rubber conforming to IS: 638 of thickness 3 mm suitable for waste water conveyance and as specified by manufacturer.

(d) Flanged joints

These shall be of PN 1.0 rating and shall comply with dimensions and drilling details as specified in IS: 8329. These shall have isolation gaskets between the flanges, isolation sleeves around all bolts and isolation washers under all bolt heads and nuts. All material shall be supplied by a reputed manufacturer and shall be approved by the Engineer.
Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The recommended bolting torque to be followed for assembling flanges shall be as specified in manufacturer's instructions. The practice of fully tightening the bolts one after another is highly undesirable. The bolts shall be of mild steel unless otherwise specified. They shall be coated with coal tar epoxy coating after tightening.

5.6 Specials

Standard DI fitting shall be in accordance with IS:9523. Wherever standard DI specials are not available, they shall be manufactured and tested as per requirements with the approval of Engineer.

5.7 Coatings

i). General

Unless otherwise specified, DI pipes and fittings shall be coated with Bitumen in accordance with relevant IS specifications. All buried DI pipes and fittings shall also have factory or site applied polythene sleeving. Coating shall not be applied to pipe and fittings unless its surface is clean, dry and free from rust. Pipe coatings shall be inspected at site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

ii). Bitumen coating

Bitumen coating shall be of normal thickness of 75 microns unless otherwise specified. It shall be cold applied compound complying with the requirements of relevant Indian standards, suitable for tropical climates, factory applied in accordance with the manufacturer's instructions.
Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

iii). Cement mortar lining

All pipes and fittings shall be internally lined with cement mortar in accordance with relevant IS. The cement used shall be Sulphate Resisting Cement confirming to IS: 12330. No admixtures in the mortar shall be used without the approval of the Engineer. The curing shall commence immediately after completion of the mortar lining, shall not be later than 8 hours after mixing of mortar. The lining shall be kept continuously in moist condition for a period of minimum 14 days.

Pipe linings shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be as per IS: 11906.

5.8. Marking

Marking shall be done as per IS: 8329 and IS: 9523 or any other relevant IS codes approved by the Engineer. The following information shall be clearly marked on each pipe,

a). Internal diameter of pipe.
b). Class of pipe.
c). Date of manufacture and
d). Name of manufacture or his registered trade-mark or both.

5.9. Carting & Handling.

Carting and handling of D.I. pipes and fittings shall be in accordance with the clause 3.4. of GSW pipes specifications.

5.10. Trenching.

Trenching includes all excavation which shall be carried out either by hand or by machine and shall be carried out in accordance with all requirements of part-2 Earth work excavations clause 2.0 to 2.17.wherever a socket or collar of pipe or fitting / special occurs, a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all round the socket in order to make the joint, and the grip shall be maintained clear, until the joint has been approved by Engineer.

Wherever D.I. pipes are laid over pillar supports for nala crossings etc. the pipes shall be placed as per the construction drawings and as directed by the Engineer In-charge.

The width of the trench shall be kept to a minimum consistent with the working space required and having regard to the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating and so as to provide the minimum horizontal clearance as stated in the table below. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline.

The portion of the trench which extends from the formation level to not less than 300 mm above the crown of the pipe when laid in its correct position, shall, unless otherwise specified or ordered by the Engineer, be formed with vertical sides. The clearance between the sides and bottom of the trench and the barrel of the pipe shall not exceed the following, inclusive of any allowances required for temporary trench supports:

Pipe Nominal Bore (mm)	Bottom Clearance (mm)	Side Clearance (mm)
350 to 600	200	300
> 600 to 800	200	350

The clearance at joints may be increased to allow the joints to be made and inspected, any proposed increase shall be approved by the Engineer.
All trenches deeper than 1.2 m shall have the trench walls battered or supported to ensure the safety of all persons working in the trench if required. The Contractor is to provide details of these arrangements for approval by the Engineer prior to any work being undertaken in such a trench.
No excavations with battered sides shall be made in roads, footpaths, private gardens, or within 10m of any buildings or other structures.
The Contractor shall erect temporary fencing around all open excavations and post warning signs in English and the local language. All fencing shall be at least 1 m tall, rigid in nature and strong enough to prevent people falling into the trench. The Contractor shall also take all other necessary measures to ensure the safety of the public and others.
The maximum length of excavation which may be left open in any length is 500 m or as directed by Engineer. The opening of two lengths within 500 m of each other shall require the approval of the Engineer.
The excavation shall be kept free of water to allow: placing of bedding, laying of pipes. inspection and testing of joints, coating of joints, placing of backfill and other activities within the pipe trench, to be carried out in a satisfactory manner.
The excavation shall be done such that it does not get far ahead of laying operations. Before excavating trench the alignment of pipeline shall be approved by Engineer. Cuttings length and other appurtenances shall be provided to suit detailed pipe configurations required.
To protect persons from injury and to avoid damage to property, adequate barricades, construction signs. red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways. The relevant Indian standards and the rules and regulations of local authorities in regards to safety provisions shall be observed.
The road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Contractor and approved by Engineer.
During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side .of the trench leaving adequate clear distance from the edges of the trench and pit, or as may be necessary to prevent the sides of the trench pit to slip or fall, or at such a distance and in such a manner as to avoid covering fire hydrants. sluice valves, manholes covers etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organisations or otherwise as Engineer may direct.
Contractor shall take into account additional excavation if any as Engineer may require in order to locate the position of water pipes, drains, sewers etc. or any other works which may be met with, in or about the excavation of trenches while quoting the rates for excavation of trenches while quoting e rates for excavation. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of shoring, strutting, planking over, padding or otherwise as Engineer ma direct, and shall be protected by the Contractor from damage during the progress of the work. Any damage to the service lines shall be borne by Contractor. All precautions shall be taken during

excavation and laying operations to guard against possible damage to any existing structure/pipe line of water, gas, sewage etc.

5.11 Deleted

5.12 Laying of pipes and fittings.

Pipes and fittings shall be laid in accordance with IS 12288 and manufacturers instructions.

The pipeline shall be constructed in lengths with a separate full time gang working on each length. The work on lengths may proceed concurrently. The programme for pipe laying shall be submitted to and be approved by the Engineer at the start of the Contract. Any subsequent changes to the programme shall be submitted to and approved by the Engineer before work to a different programme is started. Excavation for the pipeline in anyone length shall not at any time proceed more than 2 km beyond the end of a hydraulically tested, completed and backfilled length of pipe, unless otherwise approved by the Engineer. The exposed joints between tested sections shall be disregarded in the above definition.

No metal tools or heavy objects shall be permitted to come into contact with the pipes or fittings. External coated pipe shall be handled at all times with wide non-abrasive canvas, rubber or leather straps or other equipment to prevent damage to the coating. The use of chains, wire slings, or any other handling equipment found to be injurious to the coating shall not be permitted. The timber or skids used to support the coated pipe prior to lowering into the trench shall be properly padded with sufficient bags stuffed with sand or straw for the purpose of protecting the coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to the protective coating from any cause must be repaired before the pipes or fittings placed in the trench. During laying operations, no debris, tools cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and they shall be carefully cleaned before jointing.

Pipes shall be laid accurately to the lines and levels shown on the Drawings, within a tolerance of ± 10mm.

Pipe alignments shall be straight between bends or curves. Length laid to curves shall only be allowed where shown on Drawings or in accordance with detailed proposals approved by the Engineer.

Properly painted sight rails shall be supplied and erected, with boning rods of predetermined measurement for the boning of individual pipes to the correct gradient. The sight rails shall be situated vertically above the line of the pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in position on each length of pipeline under construction to anyone gradient.

The Contractor may submit to the Engineer for his approval an alternative method of the control of pipe laying to the correct levels and alignment.

The joining of pipes shall be made in accordance with the requirements of this Specification. The Contractor shall obtain from manufacturers all special information regarding the handling of the pipes, joints and other fittings and he will be deemed to have made himself thoroughly conversant with all phases of pipe laying before commencing' the' works.

A "badger" or "bung" about 10mm smaller than the internal diameter of the pipe shall be kept in the pipe at all times, pulled forward as the work progresses. When pipe laying is not in progress, including overnight, the open ends of the pipeline shall be blanked off with a temporary watertight fitting approved by the Engineer. The pipe shall be suitably held down so that the pipe does not become buoyant in the event of the trench becoming flooded.

To restrict the flow of rain runoff along the trench the Contractor shall plug the trench with backfill material at distances not exceeding 250 m until the pipeline can be filled in. The plugs shall be removed when trench filling is taking place. In granular bedding areas the plugs shall be of clay and shall be left in.

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas , sewage etc. After excavation of trenches, pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Engineer. Pipes and fittings/specials shall be carefully lowered in the trenches. Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fittings shall be made by Contractor. In no case pipes and fittings shall be dropped. Slings of canvas or equally non-abrasive material of suitable width or special attachment to fit the ends of pipes and fittings/specials shall be used to lift and lower the coated pipes and fittings/specials. The pipes and fittings/specials shall be inspected for defects and be rung with a light hammer preferably while suspended to detect cracks. If doubt persists, further confirmation shall be done by pouring a little kerosene/dye on the inside of the pipe at the suspected spot. No sign of kerosene/dye should appear on the outside surface. Pipes and fittings damaged during lowering or aligning shall be rejected by Engineer and shall be replaced by new one.

All the pipes are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipeline runs uphill in which case the socket ends should face the upgrade. The laying of pipes shall always proceed upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipes and fittings/specials of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Engineer. During the period that the plug is on, the Contractor shall take proper precautions against floating of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted the deflection allowed at joints shall not exceed 2° for 600 mm and 800 mm, 3° for 300 mm, 350 and 450 mm diameter pipes.

The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner by using tools and taking precautions as

per manufacturers' recommendations without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe: cutting machine shall be used.

The valve chamber frame and cover (Cast Iron and Fibre reinforced concrete) shall be as specified in Part 24. clause 24.3.11.

VI. MILD STEEL PIPELINE

6.1 Scope

This specification covers the general requirements for fabrication, laying, testing and commissioning of longitudinal & circumferential welded mild steel SAW pipes above /below ground, including associated civil works required for the same.

6.2 Standards

The following specifications, standards, and codes are part of this specification. All standards, specifications and codes of practice referred herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern,

IS 2062	Steel for general structural purposes
IS 808	Dimensions for hot rolled steel beam, column channel and angle sections
IS 814	Covered Electrodes for manual metal arc welding for carbon and carbon manganese steel
BS 5155	Specifications for butterfly valves
AWSS-5.1	Specification for mild steel covered arc welding electrodes
IS 3613	Acceptance tests for wire flux combination for submerged arc welding
AWS: A-5.17	Specification for Bare Mild Steel Electrodes and Fluxes for submerged arc welding
IS1367	Technical supply conditions for threaded steel fasteners.
IS2016	Plain washers
IS2074	Ready mixed paint, air dying, red oxide zinc chrome. Priming
IS1786	High yield strength deformed steel bars and wires for concrete reinforcement
IS432 (Part-1)	Mild steel & Medium Tensile bars and hard drawn steel wire for concrete reinforcement: Part 1 Mild steel and medium tensile steel bars

IS432 (Part 2)	Mild steel and Medium tensile steel bars and hard drawn steel wire for concrete reinforcement: Part 2 Hard drawn steel wire
IS 269	33 grade ordinary Portland cement
IS8112	Specification for 43 grade Ordinary Portland Cement
IS8041	Specification for Rapid hardening Portland cement
IS383	Specification for coarse and fine aggregate from natural source
IS12330	Specification for Sulphate Resisting Portland cement
IS 4353	Submerged arc welding of mild steel and low alloy steels recommendations
IS456	Code for practice for plain and reinforced concrete
IS800	Code of practice for general construction in steel
IS816	Code of practice for use of Metal arc Welding for General construction
IS817	Code of practice for Training and Testing of Metal Arc Welders
IS1182	Recommended practice for Radiographic examination of Fusion Welded Butt joints in steel plates
IS2595	Code of Practice for Radiographic Testing
IS3658	Code of practice for Liquid Penetrant Flew Detection
IS5334	Code of practice for Magnetic Particle Flaw Detection of welds
ASTM E 94	Recommended Practice for Radiographic Testing
ASTM E 109	Dry powder Magnetic Particle Inspection
ASTM E 138	Wet magnetic Particle Inspection
ASTM E 165	Liquid Penetrant Inspection
IS 3600	Methods of testing of Fusion Welded joints and Weld metal in steel
IS 483	Recommended practice for Radiographic inspection of fusion welded butt joints in steel pipes
IS 3589	Specification for seamless or Electrically welded pipes for water, Gas and Sewage
IS 6631	Steel pipes for Hydraulic purposes
IS 7343	Code of practice for ultrasonic testing for ferrous Welded Pipes and Tubular Products
IS 2598	Safety code for Industrial Radiographic Practice
IS 5822	Code of Practice for laying of electrically welded steel pipes for water supply

IS 1566	Hard drawn steel wire fabric for concrete reinforcement
IS 6419	Welding rods and bare electrodes for glass shielded are welding of structural steel
IS 1974	Bare wire electrodes for submerged arc welding
IS 7307	Approval tests for welding procedures
IS 7310	Approval tests for welders working to approved welding procedures
IS 2720	Methods of test for soils
IS 780	Specification for Sluice valves for water work purposes. (50 to 300mm size)
IS 2906	Specification for sluice valves for water work purposes (350 to 1200mm size)
IS 1916	Steel cylinder pipe with concrete lining and coating
IS 7322	Specials for steel cylinder reinforced concrete pipes
IS 11906	Recommended for cement mortar lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water.

6.3 Materials

Steel plates – The steel plates for pipes fittings, specials and stiffeners shall be of mild steel conforming to IS2062 Grade B, with no negative tolerances on the plate thickness

Cement – Ordinary Portland cement conforming to IS 269.
Aggregate – The aggregate shall confirm to IS 383
Water – The water used in preparation of concrete mix shall conform to the requirements of mixing water specified in IS : 456
Welding consumables – such as electrodes, filler rods and wires shall conform to IS 814, IS 3613, IS 6419 and IS 7280
When requested by the Engineers, the contractor shall provide test sample of the materials to be used in the works for testing. The cost of such tests shall be borne by the contractor and shall be included in his item rates.

6.4 Inspection

All works and material under specification will be rigidly inspected during all phases of manufacture and testing and such inspection shall not relieve the contractor of his responsibility to furnish materials and performed work in accordance with this specification.

The contractor will notify the engineer, in advance of the procurement of materials and fabrication thereof, in order that the employer may arrange for mill and shop inspection. The engineer may reject any or all materials or work that does not meet with any of the requirements of this specification. The contractor shall rectify or replace such rejected material/performed work at his own cost, to the satisfaction of the engineer.

The Engineer shall have free access to those parts of all plants or any other premises and sites that are concerned with the furnishing of materials or the performance of the work under this specification.

The contractor shall supply free of cost required specimen of materials for testing by the employer at any time during the progress of work and shall bear the cost of all such tests or retests to the satisfaction of engineer.

The contractor shall provide 2(two) sets of accurate “GO” and ‘No Go’ ring gauges to measure the diameter of pipes, specials and fitting for the use of the Engineer at no extra cost.

6.5 Manufactures of Pipes and Specials

6.5.1 General

The pipes shall be truly cylindrical, and straight in axis. The ends shall be accurately cut and prepared for field welding the external circumference of the pipe pieces which are to be fixed adjacent to the flange adapter with fixed outer diameter shall not deviate from theoretical one by more than 2mm. to obtain this accuracy the pipe shall be rolled several times, if necessary, as pipe pieces should be truly cylindrical. The external longitudinal welding of this pipe shall be ground smooth flush with surface to the satisfaction of the Engineer, for a length of 200 mm from the ends of the pipe. No extra cost shall be charged by the contractor for this grinding work.

Minor repair by welding or otherwise shall be permitted at the discretion of the engineer, but such repairs shall be done only after obtaining the prior permission from the Engineer. Any pipe or part thereof, which develops injurious defects during welding or other operations, shall be rejected.

6.5.2 Fabrication Yard

This fabrication yard meant for fabrication of pipes, specials etc shall also be equipped with facilities for testing, painting, lining, etc. For completing the work under the present contract within the contract period, the fabrication yard shall be equipped with adequate numbers of equipment and plant including:

- Plate bending machine for rolling of pipe drums
- Automatic welding machines (suitable for circumferential as well as longitudinal welding)
- Hydraulic welding machines
- Traveling gantry or crane of capacity 10 tonnes or above
- Mobile cranes for loading/unloading of plates, pipes etc. 15 tonnes capacity each
- Lathe for machining of the flange rings, plates etc.
- Equipment for sand blasting, cement mortar lining, and facilities for bitumen wrapping

The fabrication yard shall have adequate area, and shall also have stacking areas for the stacking of plates, pipes and fittings. The contractor shall make his own arrangements for any area required.

6.5.3 Demonstration

Contractor shall demonstrate the works in this contract at fabrication yard before commencement of works and during the works at intervals specified and as directed by the Engineer. No payment shall be made in this regard.

The works under demonstration shall include but not limited to the following:

- Manufacture of pipe and specials
- Machine and manual welding to qualify 'Welding Procedures'
- Hydraulic testing
- Pipe handling procedures

6.5.4 Cutting plates to size

The plate provided shall be utilized so as to minimize wastage and so as to make the pipe as far as possible with one longitudinal joint. Plate sizes shall generally suitable for fabrication of 1.5 m long shells (minimum), to be made up to pipes of 6.0 m to 12 m lengths to suit contractor's proposed working methods.

Before cutting, all the edges of the plates shall be cleaned by brushing/grinding both the sides.

After the plates are cut, the edges shall be made smooth and even by polishing with an electrical or pneumatic grinder to remove all inequalities. Care shall be taken to see that the cut edges of the plate are perfectly straight. Jigs to be used for this purpose shall depend upon the types of cutting machine used. The plates cut to the required shapes shall be checked for the correctness before they are rolled into pipe drums. If any correction is required, the contractor shall do the same by re-cutting, if necessary. If any plate or flat is found to be warped, to have corrugations, the defects shall be removed by putting the plate or flat into a roller press and rectified. Laminated or heavily corroded plate shall not be used in manufacturing of the pipe.

The ends of the finished pipe in the factory shall necessarily have bevel ends conforming to IS 3589 to facilitate field welded joints.

6.5.5 Rolling of Plates

The plates cut to the exact size shall be put into a rolling machine to form a pipe of the required diameter. The contractor shall adjust the rolling machine so as to give a uniform curvature to the pipe throughout its circumference. The curvature obtained shall be checked by the contractor's foremen during the process of rolling and if proper curvature is not obtained at any place including the ends, the rolling operation shall be repeated at this stage or even after the longitudinal welding of

the drum where directed. Heating of plates to obtain the desired curvatures shall not be permitted.

6.5.6 Tracking the Drums

The rolled drums shall be kept on an assembly platform for tracking, care being taken to ensure that the tacked drums have either faces at right angles to the axis of the pipe. A gap of 2 mm to 4 mm shall be maintained while tacking the drum, where the manual arc welding, is permitted. However, where the welding is to be done by automatic welding machine, there is no need to maintain such gap. To achieve this objective, clamp spiders, tightening rings and or any other approved gadgets shall be used. Each drum, before being taken to the assembly platform, shall be numbered on the inside with oil paint, stating the plate thickness as well.

6.5.7 Assembly of Drums into Pipes

The tacked drums shall then be transported to an assembly platform where they shall be welded together to form suitable pipe-lengths. Plate shall be bent in the maximum possible width to reduce the number of circumferential joints. The number of longitudinal joints shall be as per IS 3589.

The longitudinal joints shall be staggered at 90 degrees. The drums shall be tacked together as above. The assembly shall be truly cylindrical and without any kinks. The faces shall be at right angles to the axis of the cylinder. A suitable arrangement for testing the correctness of the pipe shall be provided by the contractor at the assembly platform.

6.5.8 Specials

Specials shall be fabricated to the dimensions shown on drawings. Specials, such as tees, Y-pieces, bends, tapers, etc. shall necessarily be in steel and shall be in accordance with IS 7322/BS 534/AWWA C208 and ASME standards and tested and laid in the same manner as the pipes.

Standard fittings shall be used wherever possible in preference to fabricated fittings. Standard fittings shall be manufactured in accordance with standards above. Where fabricated fittings are supplied with approval of Engineers they shall be fully workshop fabricated and tested in accordance with above standards.

Tee and branches on steel pipelines must be reinforced by welding collars around the base of the branch and in the case of large diameter branches, increasing the main pipe wall thickness or making use of crotch plates. Unless shown otherwise on the drawings branches shall comply with the requirement of the following table:

Fitting Description Pipe work O.D. (mm)	Main Pipe wall Thickness (mm)	Branch Pipe Wall Thickness (mm)	Collar Details (mm)
324 off 1320 324 off 1320 324 off 1999-	10 14/12	5.0 5.0	150 Wide x 14 to 25 Thick

Level Invert Tee 324 off 1647 324 off 1241	 14/12 11/12 8/10	 5.0 5.0 5.0	150 Wide x 14 to 25 Thick 150 Wide x 14 to 25 Thick 150 Wide x 14 to 25 Thick 150 Wide x 14 to 25 Thick

The fittings shall be designed and, if considered necessary by the Engineer, fabricated by a specialist contractor and the design calculations and drawings shall be submitted to the Engineer for approval. For oval shaped collars the width given in the above table shall be at the narrowest point. All other fittings, tees, branches, crosses and bends are to be designed by the fabricator.

Steel specials shall have the same chemical and mechanical properties and shall be compatible in all respects with the pipes with which they are to be used. The marking of pipes and fittings shall be as specified.

6.5.9 Electrodes

The contractors shall use appropriate type and size of electrodes with suitable flux covering depending on the thickness of plate and the type of joint. They shall also use standard current and voltage required for the machine in use as per manufacturers directions. Welding electrodes shall conform to IS 814 and IS 4353. Electrodes from reputed manufacturers like Advani Oerlikon, D& H, Philips etc. shall be used with the approval of Engineer. India made or equivalent foreign made electrodes of the approved quality shall be used. The contractor shall provide suitable equipment and ovens to keep the electrodes dry at the desired baking temperature.

6.5.10 Welding

Upon receipt of the order and prior to the start of fabrication, the contractor shall submit to the Engineer for his approval the ‘Welding Procedure Method Statement’ he intends to use in the shop work. At the same time the procedure for the field welding must be submitted to the Engineer for his approval.

All components of pipe shell, either straight or bent etc shall be welded by use of automatic arc welding machine by submerged arc process with alternating current. The strength of the joint shall be at least equal to that of the parent material. Manual welding shall be adopted only when machine welding is not possible.

The contractor shall use electrodes of approved make and size, the size depending on the thickness of the plate and the type of joint. Standard current and arc voltage required for the machine shall be used with necessary modifications as may be found necessary after experimental welding. For this purpose, samples of welded joints shall be prepared and

tested in the presence of the Engineer for qualifying the welded procedure Method statement. Only approved welding procedures of the Engineer shall be obtained.

All the shop and the field welding conform to IS 4353, IS 9595, IS 816.

All longitudinal and circumferential joints shall be Single-V or Double-V butt joints with or without backing plates. After completing the welding joints of pipes or plates from one side, and before the welding on the other side, the joints shall be back chipped/ gouged and ground to remove irregular penetration till the even surface is exposed. Gouging shall be restored to when the plate thickness is above 6mm.

All circumference welds involving plates of unequal thickness shall be so kept that the inside surface of plates match to provide stream lined joints without alteration in the internal diameter.

The welding shall be the best workmanship free from weld defects. In order to maintain a good standard in welding, welders shall be tested by the contractor before they are entrusted with the job. Qualification standard for welding procedures, welders and welding operators shall confirm IS 7307 and IS : 7310 (latest). Only those who pass the test shall be allowed to work on the job. Periodical tests as regards their competence shall also be taken at suitable intervals and those found incompetent shall be removed from the job. If an incomplete welder has already welded some pipes, all welding done by him previously shall be fully checked by X-ray in addition to the regular X-ray inspections. The defects if any, shall be rectified to the satisfaction of the Engineer. All such check tests and rectification of defects shall be entirely at the cost of the contractor. No pipes or steel sections shall be erected unless the work of the welders concerned has been proved to be satisfactory and qualified. Site welds shall be done by welders qualified for the various welding positions as per applicable IS codes and standards.

A record shall be maintained showing the names of welders and operators who have worked in each individual joint. Manual arc welding shall preferably be carried out by a pair of welders so that by, observing proper sequence, distortion can be avoided. A joint entrusted to a particular individual or a pair shall be as far as possible, completed by them in all respects, including sealing run. No helper or other unauthorized person shall be permitted to do any welding whatsoever.

The weldment should not become brittle or sensitive to blows and there should be no loss of toughness due to welding or heat treatment. The material after welding and heat treatment shall match with the base metal properties including original ductility. The weld should in no point be less than the nominal thickness of plate a slight reinforcement as per IS code shall be maintained on all weld joints. Final welding of closure gaps should be carried out within a temperature range of average air temperature ± 8^{o} C.

Where required by the Contractors working methods the pipes shall have cable holes /entries installed in the fabrication shop; they shall comprise a hole in the pipe with a reinforcing plate welded to the pipe with a

tapped hole in it large enough to allow the passage of the cables and other paraphernalia necessary for welding the pipes. A screwed plug shall be provided to close the hole.

6.5.11 Testing of Weld Coupons

Test pieces shall be provided by the contractors for both longitudinal and circumferential welded and joins at the positions pointed out by the Engineer the sample so taken out shall then be cut to the exact shape and dimensions and machined as described in relevant standards before testing for chemicals and mechanical properties.

The entire cost of the tests including provision of test samples, machining the test pieces, transport to and from the laboratory and testing them in a laboratory, payment of all testing fees, cleaning and painting etc. shall be borne by the contractors. The tests shall be carried out in a government or semi government institute approved by the Engineer. This shall be arranged by the contractor with the approval of Engineer. the testing laboratory shall have instruments/ equipments which are having calibration requirements traceable to National or International standards.

The following tests shall be carried out:

Mechanical Tests

The test plates shall be subjected to all mechanical tests as per the approved method statement, or as otherwise reasonably directed by the Engineer. Test shall be carried out in the accordance with relevant standards. The tests shall include determination of yield strength, tensile strength, elongation and bend tests. Tensile test shall be carried out in accordance with IS 1894. One test plate shall be provided for from each lot of 100 lengths.

If a test specimen shows defective machining or develops flaws not associated with welding, it may be discarded and another specimen submitted. The welded joint shall exhibit mechanical properties not lower than those specified for highest 2062 Grade B.

Guided bend test shall be in accordance with IS 3589/IS 3600. One bend test shall be carried out from each lot of 50 lengths. The test shall comply with the requirements specified in IS 3589/ IS 3600.

Field Joints

The field welded joints shall be tested in accordance with the proce3dure laid down in IS3600. One test plate shall be taken for every 10 joints and shall be subjected to mechanical and chemical tests as specified above.

6.5.12 Re-tests

If the results of tests of any lot do not conform to the requirements specified, retests of two additional specimens from the same lot shall be made,. Each of which conform to the required specifications, in case of failure of one or both, gouging and repairing shall be carried out to the particular lot of joints from which the samples have been taken as directed by Engineer before the lot can be accepted. The rectification

process shall also have adequate tests plates and they shall be tested for complaints with the IS codes/standards.

In case both the samples yield satisfactory results in the retest described above, gouging and repairing will be required to the carried out on the joint which has failed in the initial test only.

All charges in connection with retesting of the welded sample including machine, testing etc. shall be borne by the contractor.

6.5.13 Radiograph of Welded Joints

As soon as practicable, after welding is done, every longitudinal and circumferential welded length minimum 10% (ten percent) length of the weld at random for each pipe shall be radio graphed, to detect welding defects as per the requirement of IS4853 and as directed by Engineers. This 10% sampling will be at random but ensured 100% coverage of junctions of longitudinal and circumferential joints. If the results of such radiography fail to conform to the requirements, the contractor shall carry out 100% radiography test for the pipe as directed at the contractors cost to the satisfaction of the Engineer.

The weld repels or welds surface irregularities and slag etc., on both inside and outside shall be removed by any suitable mechanical process to a degree such that result in radiographic contact due to any remaining irregularities cannot mark or be confused with that of objectionable defect. The radiograph shall be made in strict accordance with the latest requirements and as per the latest and most efficient technique either with X-Ray or gamma ray equipment. The safety requirement during radiography shall be in accordance with IS 2598.

The radiographs are to be marked in such a way that the corresponding portion of the welded seam and the welder can be readily identified. All radiographs will be reviewed by the Engineers to identify the defects and determine those, which requires rectification. Defects that are not acceptable shall be removed by chipping; grinding or flame gouging to sound metal and resulting cavities shall be welded. After rectification, the joint is to be radio graphed again to prove the quality of the repair. The radiograph will be judged as acceptable or un acceptable by the Engineer based on the latest standards prescribed by the relevant Indian standard specification.

All X-rays shall be taken with equipment and by personal of the Contractor. Films shall be developed within 24 hours of exposure and be ready in accessible at all times for inspection by the Engineer. the contractor shall provide for the use of the Engineer suitable X-Ray viewing equipment. X-Ray films shall be properly maintained by the contractor. A complete set of radio graphs and records as described in IS : 2595, for each job shall be retained by the contractor and shall be handed over to the BWSSB on completion of the Contract. All films shall be identified by the number and chart prepared indicating location of any work associated with the pipe erection and such inspection shall be performed by the radiographer at the discretion of the Engineer.

Radio graphic inspection of welded joints:

All welded joints to be radio graphed shall be examined in accordance with

IS 2595 - Code of practice for Radiographic Testing
IS4853 - Recommended Practice for Radiographic examination of fusion welded Butt-joints in steel pipe
IS1182 - Recommended Practice for Radiographic examination of fusion welded Butt-joints in steel pipe
IS2598 - Safety Code for Industrial Radiographic Practice

Radiographer performing radiographs shall be qualified in accordance with SNT-TC-1A . Supplement and appendices “Recommended Practice for Non-destructive Testing Personal Qualification and Certification” published by the American Society for Non-Destructive testing as applicable for technique and methods used.

Final acceptance of Radiographs shall be based on the ability to see the prescribed pentrameter image and the specified hole.

Sections of welds that are shown by Radiography to have any of the following types of imperfections shall be judged un-accepectable and shall be repaired.

- Any type of crack, or zone of incomplete fusion or penetration
- Any elongated slag inclusion which has length greater than 6 mm
- Any group of slag inclusion in line that have an aggregate length greater than thickness in a length of 12 times thickness, except when the distance between the successive imperfection exceeds 6 L where L is the length of the longest imperfection in the group.
- Rounded indication in excess of that specified by the acceptance standards given earlier.

6.5.14 Tolerances

Tolerances of the plate thickness shall be ± 3%. Minimum width of the plate shall be 1.5m.

A tolerance for straight pipes shall be in accordance with IS 3589 or as amended below.

Finished pipe sections shall be truly straight with walls parallel to the axis of the pipe and shall not be out of the alignment by more than 0.2% of the total length.

The outside circumference of the pipe shall not vary by more than 0.5 per cent.

Outside diameter of the pipe shall not vary by more than plus or minus 0.5 per cent.

The permissible tolerance for specials for diameter, arm length and angular deviation shall be in accordance with IS 7322/BS 534.

Whenever any dent, i.e., a significant alteration of the curvature of the pipe shell is noticed, the depth of the dent shall be measured between the lowest point of the dent and the pipe shell curvature line. All dents exceeding 2 per cent of the outer diameter of the pipe shall be removed by cutting out a cylindrical portion of the pipe and replacing the same by

an undamaged piece of the pipe. the Engineer may permit insert patching if the diameter of the patch is less than 25 percent of the nominal diameter of the pipe. Repairs by hammering with or without heating shall not be permitted. Any damage to the coating shall also be carefully examined and rectified.

6.5.15 Pipe Testing in Fabrication Yard

A hydraulic test shall be carried out at the fabrication shop for each pipe length fabricated, in the presence of and to the satisfaction of the Engineer. All pipes and specials shall be subjected to hydraulic test at the fabrication yard after fabrication, but before application of protective coatings.

Prior to testing, the pipe shall be inspected thoroughly and all the apparent defects in welding such as slag, prosperity etc. shall be repaired by gouging and re-welding.

Each pipe shall be filled with water slowly and the pressure increased uniformly until the required test pressure is reached. The test pressure shall be 18 bars for pipes and specials with 10mm thick MS plate.

The pipe tested shall be given a serial number which shall be painted with details such as pipe number, shell thickness, diameter, length etc. as directed by Engineer. It shall be entered in the register to be maintained by the contractor. The register shall be maintained in suitable format giving the following information for each shell tested:

- Serial No.
- Pipe No.
- Date of test
- Specification and thickness of steel
- Weight of pipe shell tested
- Maximum test pressure
- Details of test performance
- Details of radiographic examination of welds
- Name of Engineer’s representative witnessing tests.
- A copy of these details shall be furnished to the Engineer.

For indicating the pressure inside the pipe an accurate pressure gauge of approved make duly tested and calibrated for the accuracy of readings shall be mounted on one of the closures which close the pipe ends.

The pressure shall be applied gradually by approved means and shall be maintained foe at least 10 minutes or till the inspection of all welded joints is done during which time the pipe shall be hammered throughout its length with sharp blows, by means of a 1 kg hand hammer.

The pipe shall withstand the test without showing any sign of weakness, leakage, oozing or sweating. If any leakage or sweating is observed in the welded joints, the same shall be repaired by gouging and re-welding after dewatering the pipe. The repaired shall be re-tested to conform to the specified pressure.

If any leak or sweating is observed in pipe shell the pipe under test shall be rejected temporarily. The Contractor shall stack such rejected pipes

separately in his yard. The Engineer shall inspect the same as shall determine the nature of repairs to be carried thereon and shall then decide as to how and where they shall be used. No payment shall be made of handling or carrying out repairs, but, payment for, fabrication and shop hydraulic testing of the pipe shall be released only after acceptance of the pipe with necessary repairs and subsequent testing etc. are carried out by the Contractor to the satisfaction of the Engineer. The Engineer shall be supplied with two copies of the results of all the tests carried out.

No pipe shall be transported out of the fabrication yard to the site unless they have hydraulically tested except permitted by the Engineer in writing to do so.

6.5.16 Marking

All pipes and specials shall bear the following markings. The marking shall be on the side which will be the inside of the pipe after bending. The marking operation shall be conducted with full size rulers and templates. Only blunt nose punches should be used.

The plates used for fabrication of pipes shall be laid out in such a way that when the shells are completed one set of original identification markings for the material will be plainly visible. In case these markings are unavoidably cut out, they shall be accurately transferred by the contractor to a location where these markings will be visible on the completed work.

After the hydraulic tests on the specials the direction of the flow shall be stamped in a prominent manner.

- Outside Diameter (mm)
- Length of pipe/angle of the bend (m/degrees)
- Plate thickness (mm)
- Approximate of weight of the pipe/special (tons)

6.6 Joints

(i) General

Unless detailed otherwise, all pipes and fittings shall have welded joints as detailed in Drawings. Where shown on the Drawings, flanged joints or collar sleeve joints shall be provided.

(ii) Welded Joints

The use of butt welded joints for joining pipes shall be in accordance with clause 6.6.10 and end preparation shall be in accordance with IS 3589

(iii) Sleeve collar joints

The use of sleeve collars shall generally be limited to the jointing of pipes at tie-ins. The thickness of the external steel sleeve collar shall be not less than that of the pipe itself and the length a minimum of 300 mm. the sleeve shall be joined to the pipe with an internal full depth structural weld and external sealing welds to allow the joint to be gas tested. A gas

testing hole shall be made at each end of the sleeve and for the purpose of gas testing joints.

(iv) Flanged Joints

Flanged shall comply with IS 7322/BS4504. The nominal pressure rating shall be at least equal to the highest pressure rating of the pipes of fittings to which they are attached, but with a minimum PN 16. The contractor shall fabricate flanges meeting the requirements of the pipe sizes under this contract or otherwise to suit the abutting valves or other connections, if they are not readily available. Flanges shall be provided with all necessary nuts, bolts, washers and gaskets, as specified herein. The Contractor shall also supply in suitable containers sufficient graphite grease for application to the bolt threads when joints are made.

(v) Slip of Type Couplings

Slip on Type Couplings shall include the following coupling:

- Straight flexible couplings
- Stepped flexible couplings
- Flange adopters
- Dismantling joints

Slip on Type Couplings shall be from the Viking Johnson System manufactured by the Victaulic Company or form approved suppliers whose fittings meet the same Specifications.

The preparation of pipe ends for slip-on Type Couplings shall be in accordance with the requirements of and the tolerances specified by the joint manufacturer. Couplings shall be installed fully in accordance with the manufacturer's recommendations.

Slip on Type Couplings shall be protected if buried with Densomastic and Densotape wrapping or similar approved material applied in accordance with the manufacturers recommendations. Flexible joints shall be harnessed or tied where shown on the Drawings. Flexible couplings and flange adaptors shall be supplied with transit protection.

6.7 Storage

Pipes and fittings shall be stored raised off the ground and shall be carefully supported, cushioned and wedged. Special care shall be taken to ensure the steel pipe is cradle and supported in a manner that prevents any distortion of the pipes.

All gaskets, nuts and bolts flange adaptors and other similar items shall be stored in the dry conditions, raised off the ground in sheds or covered areas.

Where items required special storage requirements, the method of storage shall be to the approval of Engineer and in accordance with manufactures requirements.

Storage areas shall be set out to facilitate unloading, loading and checking off materials.

All pipe materials shall be inspected when deposited in the storage area any defects or damage shall be noted and reported to the Engineer. the pipe material shall only be repaired or replace with the Engineers approval.

End covers and other protection shall noty be removed until in corporation of the pipes or fitting into the works.

6.8 Transportation and Handling

All pipes and specials fabricated in the yard and temporarily stacked in the factory shall be transported carefully to the site of laying after internal cleaning.

Any vehicles on which pipes are transported shall have a body of such length that the pipes do not overhang. Last pipes shall be placed on cradles and the loads properly secured during transit.

Additional precautions shall be taken to avoid deformation of flexible pipes. To maintain their circular cross-section internal struts shall be fitted in the pipes. Details of the proposed strutting system shall be submitted to the Engineer to the approval and if required by the Engineer, the method of strutting shall be demonstrated and tested on site.

The pipes and specials shall be handled in such a manner as not to distort their circularity or cause any damage to their coating. Wide non-abrasive or other approved slings shall be used and all hooks and other metal devices shall be well padded. Hooks engaged on the corner wall surface at pipe ends shall not be used. Steadying ropes shall be employed.

The positions of lifting slings shall ensure that stresses and tendency towards deformation in the pipes are kept to a minimum.

Pipe handling equipment shall be maintained in good condition and any equipment, which is in the opinion of the Engineer, may cause damage to the pipes shall be discarded.

Under no circumstances shall pipes be dropped, be allowed to strike one another, be rolled freely or dragged along the ground.

No valves shall be lifted by the spindle.

Fabricated materials such as man-hole covers, appurtenances, bolts, nuts, flanges, saddles, collars, bypass arrangements etc., shall be transported to the site of laying from the fabrication yard according to needs of the laying operations only.

6.9 Pipeline Construction

6.9.1 General

Laying/Erection of fabricated pipe lengths shall be carried out by the Contractor who shall equip himself, at his cost with all necessary tools, machinery, labour etc., required for the purpose. The pipeline shall be

constructed in lengths with a separate full time gang working on each length.

Except for routine welding of joints, no other work shall be done in the absence of Engineer.

The components of the sections of the pipeline such as plates, and pedestals have been so designed that the centers of the plates and pedestals shall coincide at the mean temperature of the locality. For this reason, all works such as fixing flanges, plates etc. in true alignment, and in correct position and tack welding pipes shall be done at the mean temperature. For ascertaining the temperature, the contractor shall provide mercury cups and fix them to the pipe shell from outside and shall also provide thermometers of the required type and range. No extra payment shall be made for this.

6.9.2 Laying Programme

The contractor shall submit a detailed bar chart for manufacturing and laying of the pipeline, which shall be subject to the Engineer's approval. In preparing this bar chart, the contractor shall plan his activities such that the laying of pipes shall closely follow the manufacturing schedule and no pipes shall remain in factory or at site for a period more than two months.

Together with the chart he shall submit a methodology describing how he will carry out this work within the contractual period and the required resources in terms of construction equipment and other facilities that he shall utilize to complete the works.

6.9.3 Contractor to Resurvey the Pipeline Route

While setting up the site the contractor shall undertake survey of the pipeline route and compare this with the survey supplied at the time of tender and a joint record. Levels are to be taken at 30 m intervals and at any sharp changes in level. Where practical the chainage points shall coincide with those original surveys. Not less than 14 days before commencement of pipe laying the Contractor shall supply the Engineer, any discrepancies, if observed, with two hard copies and one computer disk copy of the survey.

The format of the survey shall be identical to the longitudinal sections which formed part of the tender documents. The Engineer shall supply the contractor a copy of the longitudinal section and the contractor is to use this to produce new drawing. Details of all the benchmarks which were used in the original survey of that length of pipeline shall be supplied to the contractor by the Engineer.

The Engineer shall resolve any problem arising from discrepancies between the two surveys and supply the contractor with any revised Drawings that may be required.

6.10 External Coating with Corrosion resistant tapes

Unless otherwise specified or stated on the drawings the pipeline to be laid underground and the exposed pipeline supported on saddles shall be

coated with the corrosion resistant tapes confirming to IS: 10221-1982 Appendix B.

6.10.1 Material

(i) Primer: Primer shall be a coal tar / asphalt or suitable resin product. It shall be a liquid that can be applied without heating and shall produce an effective bond between the surface to be protected and the subsequent coating of coal tar / asphalt tape. Primer shall contain no benzol and shall not settle in the container to form a cake that cannot be mixed easily by hand stirring. Primer shall have good sparing and / or brushing properties and an minimum tendency to produce bubble during application.

(ii) Tapes: Tapes shall be comprised of coal tar / asphalt component supported on fabric of organic or inorganic fibers. The coal tar / asphalt component shall comply with quality provisions as in 4.1.2 & table 13 of IS: 10221-1982. The fabric shall be thoroughly coated and completely covered on both sides with coal tar / asphalt component. Tape shall be furnished in standard width as recommended by the manufacturer. Rolls shall be warmed on hallow course having a minimum inside diameter of 37mm. Tape shall have sufficient pliability at a temperature of 25° to unwind from the roll without disbanding the coal tar / asphalt component from the fabric.

- Length: the standard length of tape on one roll shall be 9, 15 or 23m
- Thickness: the variation in the thickness of the tape shall not exceed ± 0.125mm from the thickness specified. In no case shall thickness of the tape be less than 4.00mm.
- General requirement: when heated to a condition permitting conformation to the surface to be coated, the tape shall withstand, without tearing, the tensile force necessary to obtain a tightly wrapped coating free of voids. The tape shall provide a minimum thickness of 15 mils of coating between the steel surface and the inner face of the fabric when applied under tension necessary to provide a void free warp. Should the tape have plastic film separator of the type that is not removed prior to application, the thickness of the separator shall not adversely affect the bond between overlapped sections of tape.

6.10.2 Application of Wrapping tapes:

(i) Cleaning: Pipe surfaces shall be thoroughly cleaned and dried before the primer is applied, and shall be free of dirt, grease, oil rust, scale or other foreign matter. The pipe shall be cleaned by any one of the following mutually agreed methods.

- Grit / shot blasting
- Sand blasting &
- Mechanical cleaning.

Primer shall be applied by brush, glove or spray so as to give a coating thickness i.e., between two & four mills when wet. The primer shall be

allowed to dry to the touch prior to tape application. Primer & tape shall be furnished by the same manufacturer.

If the application is done in cold whether, the surface of the pipe shall be pre-heated until it is warm to the touch and until traces of moisture are removed, and than the primer shall be applied allowed to dry.

6.10.3 Field Application of Tape:

The tape shall be wrapped in accordance with the manufacturer's recommendations in a manner that shall meet the adhesion and holiday detection requirements of IS: 10221-1982. In any event, there shall be a minimum of 12mm overlap per single wrap. Earlier single or double wraps shall be specified by the purchaser. In application, care shall be taken that there are no air pockets or bubbles beneath the tape and shall be in intimate contact with the primed steel surface. The manufacturer shall provide assistance in demonstrating the proper method of application if requested by the contractor.

6.10.4 Field Adhesion Test:

Adhesion tests shall be made to determine the proper bond between the coal tar/ asphalt component of the tape and the properly primed pipe. The number of adhesive tests required to determine quality of application is at the inspector's option, but, desirably, no more than one test per special section, connection, or fittings should be performed to avoid extensive repair unless defects are found in the first test.

The temperature of the tape and pipe to be tested shall be between 10°C and 27°. If the temperature is outside this range, hot or cold water shall be poured over the test area until this temperature range is attained. A test area shall be selected by the inspector where the tape is smooth for 15cms in the longitudinal direction of the tape. Two knife cuts that are 15cm long and 5cms apart shall be made through the tape. A flat blade shall be used to pry up 5cm of the fabric. This 5cm flap of fabric shall be grasped firmly in one hand and shall be pulled a quick motion in the direction of the remaining 10 cm of the 15cm knife cut.

The adhesive is satisfactory if the tape tears at the point of stripping or the or the fabric strips from the under laying coal tar component, leaving exposed not more than 10 percent of the primer or metal.

6.11 Buried Pipelines

6.11.1 Trenching

Trenching includes all excavation which is carried out either by hand or by machine and shall be carried out in accordance with all general requirements of Part-5. In addition to those general requirements, the following requirements shall apply to pipelines:

The width of the trench shall be kept to a minimum consistent with the working space required and having regard to the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating and so as to provide the minimum horizontal clearance

as stated in the table below. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline.

The portion of the trench which extends from the formation level to not less than 300 mm above the crown of the when laid in its correct position, shall unless otherwise specified or ordered by the Engineer, be formed with vertical sides. The clearance between the sides and the bottom of the trench and the barrel of the pipe shall not exceed the following, inclusive of any allowances required for temporary trench supports:

Pipe Nominal Bore (mm)	Bottom Clearance (mm)	Site Clearance (mm)
600 to 1000	250	400
1050 to 2500	300	500

The clearance at joints may be increased to allow the joints to be made and inspected, any proposed increased shall be approved by the Engineer.

All trenches deeper than 1.2m shall have the trench walls battered or supported to ensure the safety of all persons working in the trench of required. The contractor is to provide details of these arrangements for approval by the Engineer prior to any work being undertaken in such a trench.

No excavations with battered sites shall be made in roads, footpaths, private gardens, or within 10m of any buildings or other structures.

The contractor shall erect temporary fencing around all open excavations and post warning science in English and the local languages. All fencing shall be at least 1 m tall, rigid in nature and strong enough to prevent people falling into the trench. The contractor shall also take all other necessary measures to ensure the safety of the public and others.

The maximum length of excavation which may be left open in any length is 500 m. the opening of two lengths within 500 m of each other shall require the approval of the Engineer.

The excavation shall be kept free of water to allow: placing of bedding, laying of pipes, welding of pipes, inspection and testing of joints, coating of joints, placing of backfill and other activities within the pipe trench, to be carried out in a satisfactory manner.

6.11.2 Bedding

The depth and type of bedding shall be as shown in the Drawings or as directed by the Engineer. Where rock or boulders are encountered, the trench shall be transmitted to a depth of at least 300 mm below the level at which the bottom of the barrel of the pipe is to be laid and filled to a like depth with sand as shown on the Drawings or as directed by the Engineer.

The class of bed and surround to be used are indicated below:

Class of bed and surround	Brief description of

	bedding material
Class N Class S	Well Graded Sand Granular material

Class S bed and surround shall be used on all pipes unless otherwise specified or shown on the Drawings.

Class N bed material shall only be used where the pipe trench is founded in hard rock or otherwise directed by the Engineer. the sand shall be clean and well graded and free from topsoil, clay or vegetable matter and to the approval of the Engineer. if the sand supplied is unclean it shall be washed. In no case shall sand containing more than 3.5% by dry volume or 5% by wet volume of clay, loam or silt be accepted. Tests specified for determining silt in sand and organic impurities as described in IS 383 shall apply.

The graded granular bed material for use in Class S bedding and surround shall consist of durable gravel, crushed stone or disintegrated rock. Selected material excavated from the pipe trench may be used, provided it contains no topsoil, clay or vegetable matter and is to the approval of the Engineer and shall be supplied with the certification which gives details of its content of the granular material shall not exceed 0.5% and 0.06% by weight respectively.

Graded Material.

The Contractor's method of grading the excavated material shall be to the approval of the Engineer. All Class S graded material shall pass through test sieves to IS 460 (Part 1) in the following proportions by mass :

Aperture Size	Percentage passing
50 mm	100%
37.5 mm	90 - 100%
20.0 mm	35 – 70%
14.0 mm	25 – 55%
10.0 mm	10 – 40%
5.0 mm	0 - 5%

6.11.3 Construction of Class S bed and Surrounds

Class S pipe bed and surround shall be constructed as indicated on the Drawings.

The granular material shall be evenly spread over the full width of the formation and lightly compacted to a level slightly higher than level corresponding to the underside of the pipe barrel to allow for settlement of the pipe to the correct level.

Following placement and jointing of the pipe further granular material shall be placed in the trench, special care being taken to fill under the sides of the pipes to ensure full contact with the barrel of the pipe.

Field joints which have not been tested shall be left exposed for a minimum length of 150 mm each side of the joint. The granular material

shall then be placed and compacted evenly on both sides of the pipe to a depth of 300 mm above crown of the pipe.

Trench supports shall be withdrawn gradually in accordance with the progress of the fill with the provisions that such withdrawal shall not prejudice the safety of the works.

The contractor shall ensure that the material to the sides of the pipe is adequately compacted in layers having a maximum thickness of 150 mm and that the method of compaction used shall achieve not less than 95 % of the maximum dry density as determined from IS 2720: Part 7

After each section of the pipeline has passed the hydraulic test, the exposed joints shall be backfilled and compacted to the above specification.

The same general requirements shall apply to Class N bedding.

6.11.4 Pipe Laying

Pipe shall be laid in accordance with IS 5822 unless otherwise specified herein.

The pipeline shall be constructed in lengths with a separate full time gang working on each length. The work on lengths may proceed concurrently. The programme for pipe laying shall be submitted to and be approved by the Engineer at the start of the contract. Any subsequent changes to the programme shall be submitted and approved by the Engineer before work to a different programme is started.. excavation for the pipeline in any one length shall not at any time proceed more than 2 km beyond the end of a hydraulically tested, completed and backfilled length of pipe, unless otherwise approved by the Engineer. The exposed joints between tested sections shall be disregarded in the above definition.

No metal tools or heavy objects shall be permitted to come into contact with the pipes or fittings. External coated pipe shall be handled at all times with wide non- abrasive canvas, rubber or leather straps or other equipment to prevent damage to the coating. The use of chains, wire slings, or any other handling equipment found to be injurious to the coating shall not be permitted. The timber or skids used to support the coated pipe prior to lowering into the trench shall not be properly padded with sufficient bags stuffed with sand or straw for protecting the coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to the protective coating from any cause must be repaired before the pipes or fittings placed in the trench. During laying operations, no debris, tools cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and they shall be carefully cleaned before jointing.

Pipe shall be laid accurately to the lines and levels shown on the Drawings, within a tolerance of +- 10 mm.

Pipe alignments shall be straight between bends or curves. Length laid to curves shall only be allowed where shown on Drawings or in accordance with detailed proposals approved by the Engineers.

Properly painted sight rails shall be supplied and erected, with boning rods of predetermined measurement for the boning of individual pipes to the correct gradient. The sight rails shall be situated vertically above the line of the pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in the position on each length of the pipe under construction to any one gradient.

The contractor may submit to the Engineer for his approval an alternative method of the control of pipe laying to the correct levels and alignment.

The joining of pipes shall be made in accordance with the\e requirements of this specification. The Contractor shall obtain from manufactures all special information regarding the handling of the pipes, joints, and other fittings and he will be deemed to have made him thoroughly conversant with all phases of pipe laying before commencing the works.

A “badger” or “bung” about 10mm smaller than the internal diameter of the pipe shall be kept in the pipe at all times, pulled forward as the work progress. When pipe laying is not in progress, including overnight, the open ends of the pipeline shall be blanked off with a temporary watertight fitting approved by the Engineer. The pipe shall be suitably held down so that the pipe does not become buoyant in the event of the trench becoming flooded.

To restrict the flow of rain runoff along the trench the contractor shall be plug the trench with backfill material at distances not exceeding 250 m until the pipeline can be filled in. the plugs shall be removed when trench filling is taking place. In granular bedding areas the plugs shall be of clay and shall be left in.

6.11.5 Level Control

The criterion for the level to which transmission main shall be laid such that the cover above the crown of the pipe to ground level shall be as specified in the drawings but in no case shall be less than 1200 mm unless otherwise directed by the Engineer.

6.11.6 Laying to Curves

Where pipes are to be laid to curves, the deflection at each joint shall not exceed one degree. For sharper curves specifically made bends shall be provided.

6.11.7 Lowering and Jointing

The pipe shall be lowered into the trenches such that no part of any shoring is disturbed or damaged and if necessary, additional temporary struts may be fixed during the lowering operations. Care shall be taken to ensure that the longitudinal joints of two consecutive pipes at each circumferential joint are staggered by 90 degree. While assembling the pipes, the ends shall have to be brought close enough to leave a uniform

gap not exceeding 4 mm. there shall be no lateral displacement between the pipe faces to be joined. If necessary, spiders from inside and tightening rings from outside or other suitable equipment shall be used to bring the two ends in perfect contact and alignment. In no case shall hammering or longitudinal slitting be permitted. Jacking may be permitted for this purpose in particular circumstances and approval by the Engineer.

When the pipe is properly assembled firmly supported on wooden beams and wedges or by other approved means it shall be checked for correct line and level and tack welded. The tack welded circumferential joints shall then be welded fully.

On completion of the pipe jointing the external portion shall be coated with M15 concrete and the trench and the welding pits shall be cleaned. The welding pit shall be filled with approved bedding.

6.11.8 Floatation

The contractor shall take proper precautions against the risks of floatation and the flooding of the excavated works and shall make due allowances in his programme for any closure he considers necessary on account of monsoon.

Should any section of the pipeline be affected by floating in the course of works the entire work shall be removed and then reinstalled to the satisfaction of Engineer. The entire cost of laying it again to the correct line and level shall be to account of the Contractor.

6.11.9 Steel Props

In order to effectively provide cement mortar lining to the inside of the pipes and to avoid difficulties during the work, it is necessary that the roundness of the pipes is maintained circular till the lining work is taken up. To achieve the same, steel adjustable screw type props of screw or similar approved type consisting of minimum six legs(three props) shall be fixed inside the pipe and the diameter correctly set.

The design and drawings of the props that the contractor intends to use should be approved by the Engineer before starting the work. These props shall be fixed vertically at intervals as directed by the Engineer. The props should be kept in position at least for three days after the encasing of the pipe in that section is completed or until refilling is done to the full height of fill over the pipe in case the pipes are not encased. The props shall be removed only after obtaining permission from the Engineer.

6.12 Internal Cement Mortar Lining

All pipes and fittings shall be internally lined with cement mortar in accordance with IS:11906/AWWA C602. Cement mortar in lining shall be applied in-situ after pipe laying and after sectional hydraulic testing.

Cement shall be Portland cement in accordance with IS 8112

Sand used for lining shall be tested with standard sieves as per IS 460 and requirements specified in IS 11906

The minimum cement content shall be 100 kg/m3 and the water : cement ratio by mass shall be between 0.3 and 0.45:1

The mortar shall stop 100 mm back from the faces of any joints. The end face shall be vertical.

6.12.1 Surface Preparation

The interior surface of the pipe to be lined shall be cleaned to remove all rust, chemical or other deposits, oil, grease and all accumulations of water, dirt, and debris. The cleaning of the surface shall be carried out by the use of suitable chemical or mechanical means to the approval of the Engineer. The extent of cleaning shall be to the satisfaction of the Engineer.

All loose mill scale, dirt, rust, and accumulation of construction debris shall be removed from the interior of the steel pipeline. The pipeline shall be cleaned by use of a power-driven cleaner incorporating revolving brushes on rotating arms.

Immediately prior to the travel of the lining machine through the pipeline, all foreign material shall be removed. This includes small sand and loose mortar that might have accumulated since the work of preparation of surfaces was completed.

6.12.2 Mix Proportion

Proportion of sand to cement shall not be more than 1.5 parts sand to 1 part by volume. Mortar composing of cement, sand and water shall be well mixed and of proper consistency to obtain a dense, homogeneous lining that will adhere firmly to the pipe surface. The cement mortar mix shall comply with strength and density requirements specified in IS 11906/AWWA C602. No admixtures shall be permitted unless approved by the Engineer.

6.12.3 Thickness of Lining

The lining shall be placed by centrifugal method in one course by a machine traveling through the pipe and discharging the mortar at a high velocity over all pipe sections and long radius bends. The discharge shall be from the rear of the machine so that the freshly applied mortar will not be marked. The rate of travel of the machine and the rate of mortar discharge shall be mechanically regulated so as to produce uniform thickness throughout. The mortar must be densely packed and shall adhere to the pipe wherever applied.

6.12.4 Surface Finish

Mortar lining shall be mechanically trowel led except for the places where hand toweling is expressly permitted by the Engineer.

The lining shall be provided with attachments for mechanically trowel ling the mortar. Both the application and toweling of the mortar shall

take place at the rear of the machine so that the freshly placed and trowel ling of the mortar will not be damaged. The trowel attachment shall be such that the pressure applied to the pipe will be uniform and produce a lining of uniform thickness with a smooth and even finished surface free of spiral shoulders. The finished surface of machine placed and trowel led linings in pipe shall be examined according to the following procedure.

Thickness of lining shall be ascertained frequently during placing of mortar and trowel ling using an approved non-destructive method.

In the stretch of pipe that has been lined and trowel led in each day's run, ten places shall be selected in straight sections of the pipe by the Engineer. In each of the ten places the thickness of the lining shall be re measured by non-destructive means as directed by the Engineers.

Defects in lining including but not restricted to sand pockets, voids, over sanded areas, blisters, cracked and dummy areas, and thin spots shall be removed, and the area shall be repaired to the full required thickness of the mortar lining. Defective areas encompassing the full diameter to the pipe shall be replaced by machine. Defective lining rejected at the time of lining shall be removed before initial set of the mortar. Defective lining rejected after initial set shall be replaced or repaired by the most practical method as determined by the Engineer.

Hair cracks or cracks up to 0.25 mm width and not over 300 mm in length in finished linings may be considered acceptable at the discretion of the Engineer but larger cracks shall be repaired or removed and redone all as directed by the Engineer.

6.12.5 Hand application

Cement mortar lining of bends, specials, areas closely adjacent to valves and other such places where machine placing may not be practical shall be performed by hand. The Engineer may order the correction for any defect by hand application.

Cement mortar for hand work shall be of the same materials as the mortar for machine placed lining.

The areas to be lined shall be thoroughly cleaned as specified earlier and, if necessary, shall be moistened with water immediately prior to placing the hand- applied mortar.

Steel finishing trowels shall be used for the hand application of cement mortar, except at bends the outer edges of hand trowel led areas may be brushed in odder to reduce the abutting offset.

All hand finishing work in a section of the pipeline shall be completed within 24 hours after completion of the machine application of mortar lining that section. If necessary, application of mortar lining by machine shall be delayed or stopped to assure compliance with this schedule.

Hand placed mortar shall have a uniform and smooth surface with smooth transitions to adjacent machine placed linings.

6.12.6 Curing

Curing shall commence immediately after completion of the mortar lining and hand finishing of a section of pipeline. This shall, not be later than 8-hours after mixing of mortar. The lining shall be kept continuously in moist condition for a period of 14 days. During the operation of lining, finishing and curing, exterior surface of the pipe exposed to sunlight shall be sprinkled with enough water to keep the pipe cool. Open ends of pipes shall be suitably closed so as to maintain a moist atmosphere and prevent draught. Curing of mortar lining and simultaneous cooling of the pipeline externally shall be continued even beyond the period of 14 days if so directed by the Engineer.

6.12.7 Tests

Test blocks of the same material as used for the lining shall be made in 150 mm cube moulds and subjected to cube crushing tests. Each block shall be removed from its mould as soon as practicable and cured under the conditions of temperature and humidity identical with those in which the lining of the pipe is cured. The number of tests shall be at least 4 cubes for each age and water cement ratio for each days work. The work cube strength of the test cube shall not be less than 300 kg/cm^2 after 28 days of curing or 170 kg/cm^2 of 7 days of curing. The density of the test cube shall not be less than 2300 kg/m^3

6.12.8 Backfilling

On completion of the pipe laying operations in any section, for a length of about 100m and while further work is still in progress, refilling of trenches shall be started by the contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of trench excavation and the contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he is satisfied with the progress of laying and testing of pipes and refilling of trenches. Filling to a level of 300 mm above the crown of the pipe shall be done in accordance with the requirements of the clause on bedding. Care shall be taken during backfilling, not to injure or disturb the pipes, joints or coating. filling shall be carried out simultaneously on both sides of the pipe so that unequal pressure does not occur. walking or working on the completed pipeline shall not be permitted unless the trench has been filled with the instructed bedding and surround material, up to height of at least 300 mm over the top of the pipe except as may be necessary for trapping etc., during backfilling work.

The remaining portion of the trench shall be filled in which selected excavated material free from and topsoil, vegetation or boulders and colds of earth larger than 75 mm in size. Filling shall be done in layers not exceeding 150 mm in thickness accompanied by adequate watering, ramming etc., so as to be compacted to 95 % of the maximum dry density as per Part 7 of IS: 2720. The water contents of the soil shall be kept near the optimum moisture content as possible. The trench shall be refilled so as to build up to the original ground level, keeping due

allowances for subsequent settlement likely to take place. The surface of the refilled excavation shall be left slightly higher than the adjacent ground and be maintained by the contractor to a smooth even slope.

The Engineer shall, at all times, have powers to decide which portion of the excavated materials shall be used for filling and in which portion of the site and in what manner it shall be used.

If suitable material for refilling is not available from already excavated material the Contract shall import material of approved quality as directed by the Engineer.

Regular measurement of the field dry density shall be taken by the Contractor at various levels in the backfilling as required by the Engineer.

No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval for the Engineer has been obtained.

Should any subsidence take place either in the filling of the trenches or near about it during

The works the Contractor shall make good the same at his own cost.

Surplus excavated material shall be used to fill in any low spots above the pipeline which are identified on the Drawings or are instructed by the Engineer. Such material shall be evenly placed and compacted in layers not exceeding 200mm thick after compaction. The method of compaction employed shell achieve not less than 90% maximum dry density as determine from IS 2720: Part 7. Unless approved of by the Engineer, the width of areas to be filled shall not exceed 20m.

6.13 Valves

6.13.1 General

Valves shall be as per IS recognized standards. Flanges shall be machined on faces and edges to ISO 7005, IS 6392 or BS 4504.

Valves shall be double-flanged type and the face shall be parallel to each other and flange face should be at right angles to the value centerline. Backside of value flanges shall be machined or spot faced for proper seating of the head and nut.

Valve buried or installed in underground chamber, where access to a hand wheel would be impractical, shall be operated by means of extension spindle and/or keys.

Valves of diameter 450 mm and above shall be provided with lifting eyes and shall have detachable bolted covers for inspection, cleaning and servicing.

Valves shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position

The valve stem, thrust washers, screw, nuts and all other components exposed to water shall be of a corrosion resistant grade of stainless steel.

Valves shall be free from sharp projections.

Butterfly and non-return values shall be provided with bypass arrangement. This may be integral with value or connected between pipes.

6.13.2 Butterfly Valves

Metal seated butterfly value shall be as per IS 13095/ BS 5155. Valve shall be suitable for mounting in any position.

The valve seat shall be of integrally cast or replaceable design. When the value is fully closed, the seal shall seat firmly so as to prevent leakage. The seat surface shall be machined smooth to provide a long life for the seal.

All fasteners shall be set flush so as to offer the least resistance possible to the flow through the valve.

All valve, spindles and hand wheels shall be positioned and vice versa shall be limited to about 5 minutes. The valve shall be suitable for controlling flows by throttling.

Valves shall be provided with enclosed gear arrangement for ease of operation. The operation gear shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation on a reasonable time and not exceed a required rim pull of 400 N.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels. Hand wheel shall be provided with an integral locking device to prevent operation by unauthorized person.

Material of Construction:

Body: Cast steel (Conforming to ASTM A216 Gr WCB)
Disc: Cast steel (Conforming to ASTM A216 Gr WCB)
Shaft: Stainless Steel (BS 970 431 S29)
Seat Ring: Stainless Steel: ASTM A 743 CF8
Bearing: Teflon

Size of valves and pressure rating as per Bill of Quantities. Location of valves shall be as per contract drawings.

The contractor shall provide test certificates for materials, strength and leakage shall in accordance with BS5155 or relevant international standards.

6.13.3 Sluice Valves

Sluice valve shall conform to IS 780 and IS 2906 or relevant internationally recognized standards.

They shall be of non-rising spindle type. The valve shall be furnished with a bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5 mm

The gate face rings shall be screwed into the gate or alternatively securely pegged over the full circumference.

All valves, spindles and hand wheels shall be positioned to give good access for operational personnel.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Materials of Construction:

Body of gate	Cast iron to IS: 210 Gr FG 200
Spindle	Stainless steel BS 970 gr 431 S29
Seat Rings	Stainless steel ASTMA 743 CF8
Back Seat Bush	Bronze; IS 318 Gr LTB2
Shoe & Channel Lining	Bronze; IS 318 Gr LTB2

Size of valves and pressure rating as per Bill of Quantities. Location of valves shall be as per contract drawings. The contractor shall provide test certificates for materials, strength and leakage shall be in accordance with BS 5150/ IS 750.

The design and locations of washouts are shown in drawings. Exact positioning shall be determined by the Engineer with regard to topography. With regard to washouts at least 3 m of the washout pipe work, inclusive of the isolating valve, measured from the center line of the pipeline shall be laid at the same time as the pipeline and suitably capped to prevent ingress of foreign material. The minimum gradient for the washout pipe work shall be 1 in 100, if not shown in Drawings.

6.13.4 Air valves

The air valve shall be capable of exhausting air form pipe work automatically when being filled. The air being released at a sufficiently high rate to prevent the restriction of the inflow rate. Similarly the valve shall be capable of ventilating pipe work automatically when being emptied, the air inflow rate being sufficiently high to prevent the development of a vacuum in the pipelines. The valve shall also automatically release air accumulating in pipe work during normal working conditions.

Air valve shall be of the double orifice type with a large orifice for air entry into the pipeline and smaller orifice for automatic release of air under normal working pressure. The valve shall be suitable for the maximum working pressure in the systems. All air valves shall be provided with isolating valve and flanged end connections.

Air valve shall be designed to prevent premature closure prior to all air having been discharged from the line. The orifice shall be positively sealed in the closed position but the float (ball) shall only be raised by the liquid and not by a mixture of air and liquid spray.

The seating shall be designed to prevent the floats sticking after long periods in the closed position.

Air valve shall comprise of cast iron body having faced and drilled flange at inlet and with two chambers each housing a ball. One chamber shall have small orifice and other a large orifice. Balls shall be of injection moulded plastic with high impact strength or any other suitable approved material.

Materials of Construction:

Body/cover	Cast Iron (IS 210 Gr FG 220)
Seat ring	Gun metal (IS 318 Gr II)
Float/Balls	Vulcanite

Valves shall be DN 200 and shall be PN16 pressure rating. Location of valves shall be as per contract drawings.

The contractor shall provide test certificates for materials and properties shall be in accordance with relevant standards.

Before carrying out pipeline pressure testing the contractor shall verify with the supplier of the air valves that the valves have the capacity to sustain the pipeline test pressures. In the event that they do not sustain the pressure the valves shall be removed and the stubs off the pipeline shall be blanked off before pressure testing the pipeline.

6.13.5 Stubs

Stubs for air valves, scour valves and pressure relief valves of required dimensions as specified in the drawings shall be fabricated by the contractor and shall be fixed to the pipeline.

6.13.6 Nuts, Bolts and Washers

Unless otherwise specified, nuts, bolts and washers shall be galavanished and/or zinc electroplated conform to the requirements of IS 1364. Bolts shall be of sufficient length that at least one thread but not more than three threads shall show through the nut when in the fully tightened condition.

6.14.1 Anchor Blocks

Anchor blocks shall be provided at horizontal bends, vertical bends/ and at intervals on pipelines with gradients in excess of 1 in 6 as noted on the drawings, and at other locations ordered by the Engineer. The anchorages shall be made from concrete and constructed to the dimensions shown on the drawings. Where faces of anchor blocks are shown to bear against undisturbed ground, the contractor shall take all necessary measures to ensure that such bearing is given over the full dimensions shown.

Curves formed by welded bends and pipe lengths will not require anchoring unless specifically shown in the drawings.

Welded pipelines shown on the drawings as having tied couplings an flanges shall require anchor blocks only at the positions specifically noted on the drawings.

6.14.2 Vertical Thrust Blocks

Vertical thrust blocks shall be located wherever there is a transition between above ground and buried pipelines. All vertical thrust blocks shall have flexible joints at either end to allow for small amounts of settlement to occur. The contractor shall undertake the construction of the thrust blocks as early in of settlement to occur. The contractor shall undertake the construction of the thrust blocks as early in the programme of work as is practical and at least six months prior to the installation of the above ground pipeline, in order to reduce the risk settlement of imposing additional loads on the pipeline supports.

Where possible the base of the thrust block shall be cast against solid rock in order to prevent any settlement. Any material overlaying the rock shall be excavated and replaced with class M15 mass concrete. In the event of no rock being encountered the base of the thrust block shall be cast against undisturbed ground. Any ground which in the Engineer's opinion is unsuitable shall be excavated and replaced with class M15 mass concrete.

6.15 Internal Cleaning of Pipeline

Pipeline shall be cleaned of all dirt, debris, dust or other deposits by repeated hosing of copious quantities of water on the pipe surface and simultaneously rubbing the surface with gunny cloth to the satisfaction of Engineer. Cleaning with metal cleaning solution, acid, wire brushes, scrappers or sand paper shall not be permitted.

The section of the pipeline once cleaned shall not be entered into for any purpose later. Sufficient precaution shall be taken to prevent the ingress of any dirt, debris, or dust inside the section. Failing this the section shall be cleaned again at the discretion of the Engineer.

In the case of above ground pipeline, the length of the section to be taken up for cleaning shall be decided in consultation with the engineer from the point of view of ventilation etc.

In case of buried pipeline a section shall be taken up for cleaning after the work of back filling around and over the pipeline is completed and the spiders have been removed from inside with approval of Engineer.

During the pipeline operation in the adjoining section, the contractor shall take all the precaution to prevent ingress of water, debris, dirt, etc in the cleaned section, failing which the section shall be cleaned again at the discretion of the Engineer. When deemed necessary by the Engineer suitable closures shall be provided at the open end or the ends of the cleaned section.

No separate payment will be made for the work of cleaning and providing closures. The rates coated for the laying of pipes shall include the cost of cleaning also.

6.16 Hydraulic Testing Pipeline

Pipelines and fittings shall be subjected to hydraulic pressure test in the presence of the Engineer which shall comply with IS 5822 unless otherwise specified.

Testing shall be carried out in two stages:

Test of section as construction proceed before internal cement mortar lining

A test of the hole of the pipeline on completion

The contractor shall equip with all plants, equipment, fittings and water necessary for the hydraulic tests. The contractor shall submit to the Engineer, well in advance of the time of test, details of proposals, including the supply of water either by tankers or bore holes. No connections from the existing pipelines will be allowed, nor will any connection to the pipeline and pipe work which would involve cutting, tapping or altering the permanent works be allowed.

Test gauges shall be of approved manufactures having dials at least 200 mm diameter, graduated such that the test pressure is at least 75% of the full-scale reading shall be used. If necessary different gauges shall be supplied for different pipeline section. Two gauges shall be provided for the sole use of the Engineer and shall remain in the engineer possession for the duration of the contract. All gauges shall be dead weight tested and calibrated at the commencement of work and at regular intervals as require by the Engineers.

The contractor’s arrangements for testing shall include a suitable means of quick installation and removal of the Engineers gauges during testing.

6.16.1 Testing Procedure

The sectional hydraulic test shall be carried out after the pipeline section to be tested as been laid, jointed and back filled to a depth sufficient to prevent flotation, but leaving the joints exposed which have not been tested. The sections to be tested shall be to the approval to the Engineer and shall be not longer than 2000m or 500 m when either pipeline is laid adjacent to or underneath the carriage way or when section includes an air valve chamber. The joints between each tested section shall be left exposed until the pipeline has passed the test on completion.

This test shall be undertaken within one month of the contractor commencing the laying of the pipes. Should the pipeline fail the test or the contractor fail to undertake the test, all laying and welding work shall come to a halt until that section of pipeline passes a hydraulic test.

Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces which will be exerted when the test pressure is applied. Testing against closed valves will not be permitted. Washout valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test.

Proposals for testing where thrusts on structures are involved, even where thrust flanges on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval.

The method of filling the pipeline with water shall be approved by the Engineer. The length under test shall be filled making certain that all air is displaced through an air valve installed at the top of the blank flange situated at the high end of the line. The length shall then remain under constant moderate pressure, 10 to 20m head of water, for a period of several hours until the pressure can be maintained without additional pumping.

The pressure shall then by slowly increased at a maximum rate of 1 bar per minute to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10 m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe length shall passes the test if the leakage is not more than 0.33 liters per mm diameter per kilometer per 24 hours for each 100m head of pressure applied.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint and repeat the hydraulic test.

No pipeline shall be accepted until the leakage on any length is not more than the rate of leakage specified above and all sources of leakage have been rectified.

The test on completion shall be carried out after all the pipeline sections have been satisfactorily tested and the joints between each section completed to provide a continuous test length between pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the works that have been designed for stresses limited by considerations other than those applying to the pipeline systems.

6.16.2 Test Pressures

Test pressures are to be measured in bars at the center of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified or shown on the drawings pipeline test pressure shall be in accordance with the following:

Steel pipe and fittings 8, 10 and 11 mm wall thickness 18 bar

Test pressure for sections of pipeline containing air valve chambers shall be such that the pressure at the chamber does not exceed valve design pressure as specified by manufacturer.

When undertaking a Test on completion of the pipeline length may contain pipes of different wall thickness in such cases the lower of the different test pressures shall be used.

6.17 Pipeline Disinfections

Upon completion of a newly laid main, the main shall be cleaned, disinfected and dewatered as directed by the Engineer.

The internal surface of pipelines, specials, appearances shall be disinfected using chlorine solution in accordance with procedure specified in IS 5822. Alternative methods may be adopted with the approval of the Engineer. The chlorinated water shall stand in pipeline for a minimum period of 24 hours and all valves in the system shall be operated twice during this period.

The chlorinated water shall be neutralized and disposed off as directed by the Engineer.

After final flushing and before the pipeline is placed into service, water samples shall be collected and tested for bacteriological quality and shall not indicate the presence of califorms. If the initial disinfections fail to produce satisfactory results, disinfections shall be repeated until satisfactory samples are obtained.

The contractor is expected to carry out the cleaning, disinfecting and dewatering work as a part of laying the pipes and his rates for laying the pipes should include the cost of cleaning and other related works.

6.18 Markings

Details like valves type, size, and cistern number shall be painted on the valve chambers as directed by Engineer.

6.19 Measurement and Payment

The measurement of the pipes for items specified in Bill of Quantities shall be on running meters of net length along the centerline of the pipe excluding the length of specials and appurtenances.

Specials shall be paid separately on the basis of provision made in the Bill of Quanitities. For the payment purpose, flanges shall be either included in or excluded as described in the Bill of Quantities. However materials such as nuts, bolts, and washers, etc., shall be included in the respective terms.

Valves shall be paid on number basis as mentioned in the Contract Data.

Payment for fabrication of pipes and specials shall be made after successful testing and delivery to work site. Payment for laying the pipes and specials shall be made as mentioned in the Contract Data.

Lining and coating shall be measured by surface area coated or lined in square meters. For coating the outer diameter (before coating) of pipe

barrel shall be considered and for lining internal diameter (before lining) of pipe barrel shall be considered.

VII. ANCILLARY STRUCTURES

7.1 The Contractor shall build Valve Chambers & Thrust Blocks/Anchor blocks and such other miscellaneous structures that may be required at the locations shown by the Engineer and as shown in the drawings or as may be otherwise specified or directed. unless otherwise specified in this Chapter or advised by the Engineer based on the site conditions.

The various structures shall be built as the pipe laying progresses and the Engineer at his discretion, may stop work entirely on the laying of pipe or construction of other structures, until the construction of the structures already approved by the Engineer are completed by the Contractor.

7.2 Thrust Blocks

Thrust blocks shall be provided for both horizontal and vertical bends as suggested, for effective transfer the hydrostatic thrust developed during the operation of the rising main. They shall be constructed at the locations shown in the alignment drawings, and are of the respective dimensions shown therein. The surrounding virgin land of the thrust blocks shall not be disturbed, to effectively transfer the thrust developed in the main.

7.3 Valve Chambers

RCC valve chambers shall be provided for all valves. These valve chambers are of different sizes suitable for air valves, scour valves & Control valves with RCC pre-cast slabs covering.

7.4 Structures for Crossing Canal/ Nallahs and Other Miscellaneous Structures

Structures for crossing the pipeline over canals/Nallahs and other miscellaneous structures not listed in these specifications but may be required to be built shall be as per construction drawings and as described in Bill of quantities. The materials of construction of workmanship for those structures shall conform to the relevant Standard Specifications. The measurement of quantities involved in these structures for payment shall be done as per dimensions of the respective drawings.

7.5 Grade of concrete

7.5.1 Ordinary Concrete

In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume. The ordinary concrete shall be in four grades designated as M 7.5, M 10, M 15 and M 20. It can also be specified by volumetric mix as given in Table-4 below. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic meters in volume. Shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume and in case it is damp, allowance for ‘bulkage’ shall be made as per IS: 2386 (Part III).

Ingredients required for ordinary concrete containing one bag of cement for different proportions of mix shall be as given in Table-4 below.

Table-4

Ingredients Required for Ordinary Concrete

Grade of Concrete *	**Nominal Mix by volume Cement: Fine Aggregate: Coarse Aggregate****	**Total quantity of dry in kg (max) by mass per 50 kg of cement (to be taken as the individual masses of fine and coarse aggregates)**	**Quantity of water in liters (max) per 50 kg of cement*****
M 7.5	1:4:8	625	45
M 10	1:3:6	480	34
M 15	1:2:4	350	32
M 20	1:1.5:3	250	30

* In the designation of a concrete mix, letter 'M' refers to the mix and the number refers to the specified 28 days' works compressive strength of that mix on 150 mm cubes, expressed in N/ sq. mm.

** The proportions of the aggregate shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.

*** The amount of water should be kept minimum required for proper workability. The quantity given in the column is not to be exceeded.

7.6 Strength Requirement of Concrete

Where Ordinary Portland Cement conforming to IS.269 or Portland Blast Furnace Cement conforming to IS:455 is used, the compressive strength requirements for various grades of concrete controlled as well as ordinary shall be as given in Table-5. Where rapid hardening Portland cement is used, the 28 days compressive strength requirements specified in Table-5 shall be met at 7 days.

For controlled concrete, the mix shall be so designed as to attain in preliminary tests a strength at least 33 per cent higher than that required on work tests for concrete up to and including M 25, and 25 per cent higher for higher grades. Preliminary tests need not be made in case of 'ordinary concrete'.

Table-5

Strength Requirements

Grade of Concrete	**Compressive test Strength on 150 mm cubes after testing in accordance with IS: 516 (N/sq.mm)**	
	Minimum at 7 days	**Minimum at 28 days**
M 10	7	10
M 15	10	15
M 20	13.5	20
M 25	17	25

In all cases, the 28 days compressive strength specified in Table-5 shall alone be the criterion for acceptance or rejection of the concrete.

Where the strength of a concrete mix, as indicated by tests, lies in between the strength for any two grades specified in Table-5, such concrete shall be classified for all purposes as a concrete belonging to the lower of the two grades between which its strength lies.

7.7 Use of Plums in Ordinary Concrete

Stone Plums shall not be used unless specified in the drawings. When stone plums are used, the size may be from 150 to 300 mm. The maximum dimension of these stones or plums shall not exceed 1/3rd the least dimension of the members.

All plums shall be hard, durable, clean and free from soft materials or loose pieces or deleterious substances in them and shall not have sharp corners.

During concreting the first layer of concrete of the specified mix shall be laid to a thickness of at least two and a half times the thickness of the maximum size of plums to be used. The plums shall then be laid while the top portion of this concrete is still green but sufficiently stiff to prevent complete submergence of the plums under their own weight. These plums shall be about half embedded in the concrete and the remaining part exposed so as to form a key with the next layer of concrete. No plums shall be used for concrete-laid under water.

While placing the plums, care shall be taken to see that the clear distance between any two plums is not less than either the width or thickness of either of the plums. The distance from plums to the outer surface or from any steel reinforcement shall be equal to greatest width of the plum.

If plums of stratified stone are used, they shall be laid on their natural bed. Stones with concave faces shall be laid with the concave portion upwards. The thickness of the next and successive layers of concrete shall be at least twice that of the largest plums. The total volume of plums shall not exceed 15% of the volume of the finished concrete

SECTION 7: DRAWINGS

SECTION 8: BILL OF QUANTITIES

				Rate (Rs)		
Sl. No	Description of item (with brief specification and reference to Book of specification)	Quantity	Unit	In figures	In words	Amount (Rs)

Total Tender Price (in figures)						
(in words)						

Note:

(1) Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 11.2 and CC Clause 37.2).

(2) Unit rates and prices shall be quoted by the Tenderer in Indian Rupees.

(3) Where there is a discrepancy between the rate in figures and words, the lower of the two will govern. [ITB Clause 24.1(a)]

(4) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern [ITB Clause 24.1 (b)]

SECTION 9: FORMAT OF BANK GUARANTEE FOR SECURITY DEPOSIT

To: _____ [name of Employer]
_____ [address of Employer]

WHEREAS _____ [name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Rs._____ [amount of guarantee] [2] Rupees_____[in words], and we undertake to pay you, upon your first written demand and without cavil or

[2] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

argument, any sum or sums within the limits of _____ [amount of guarantee][3]as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until 30 days from the date of expiry of the Defects Liability Period.

Signature and seal of the guarantor _____
Name of Bank _____
Address _____
Date

_____

ANNEXURE-A

[3] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

DETAILS OF JURISDICTIONS OF THE COURTS AND SAFETY MEASURES TO BE INCLUDED IN THE CONTRACT AGREEMENT

1. Jurisdiction of courts / Arbitration:The sitting of arbitration shall be held at Bangalore
   only and nowhere else.
2. Dispute of any kind arising out of the contract shall be resolved within the jurisdiction of Bangalore city only and the parties agree and clearly understand that the courts/ tribunals situated at Bangalore metropolitan city have exclusive jurisdiction for the redressal of the disputes arising out of the contract and at no other place
3. The parties further agree and understand that the place or places of issue of bank guarantee other than Bangalore will have no jurisdiction to resolve dispute of any kind relaying to enforcement of the bank guarantees submitted by the contractor at Bangalore for the execution of the contract at Bangalore
4. The contractor shall comply with all the legal requirement in the matter of employment of workmen and provide all safety gadgets to the workmen while working in the hazards place or conditions during the execution of the contract.
5. Contractor shall be fully responsible in the event of death of employee/workman during the execution of the work and liable to pay adequate compensation to the dependants of employee/workman as per law.
6. On his/their failure, if the board is made to pay compensation the same shall be recovered by the board from the contractor out of the amounts due to the contractor or by appropriate legal action.
7. If death of any employees occurs during execution of work due to negligence of contractor, the contract will be liable for termination.
8. In the event of such termination, the employer may consider blacklisting of firm after due notice.
9. In case of any death accident the contract will be cancelled after following the process.
10. The Board will be entitled to claim exemplary damages from the contractor in case of death of any work man/employees of the contractor in any of the BWSSB works as it damages the reputation of the Board.